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Drosera buubugujin M.T.Mathieson (Droseraceae, *Drosera* section *Prolifera* C.T.White), a spectacular new species of sundew from the Cape York Peninsula bioregion

Michael T. Mathieson & Simon L. Thompson

Summary

Mathieson, M.T. & Thompson, S.L. (2020). *Drosera buubugujin* M.T.Mathieson (Droseraceae, *Drosera* section *Prolifera* C.T.White), a spectacular new species of sundew from the Cape York Peninsula bioregion. ***Austrobaileya* 10(4): 549–557**. *Drosera buubugujin* is described as new. It is a terrestrial herb known only from Muundhi and Juunju Daarrba Nhirrpan National Parks (Cape York Peninsula Aboriginal Land - CYPAL) in northern Queensland and is readily distinguished from any other members of the genus by its unique combination of characters. The species is illustrated and diagnosed herein. A key is provided to the species of *Drosera* section *Prolifera*. Its conservation status is assessed and a status of Critically Endangered is recommended.

Key Words: Droseraceae; *Drosera*; *Drosera buubugujin*; Australia flora; Queensland flora; new species; taxonomy; identification key; conservation status

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Introduction

Queensland's Wet Tropics bioregion hosts a multitude of unique flora including the three species of sundew comprising *Drosera* section *Prolifera* C.T.White (White 1940; Schlauer 1996; Lowrie *et al.* 2017a,b;), *viz. Drosera adelae* F.Muell., *D. prolifera* C.T.White and *D. schizandra* Diels. These species are commonly known amongst sundew enthusiasts as "The Three Sisters" (Nunn & Bourke 2017) and "the rainforest *Drosera*" (Lavarack 1979; Lowrie 2013).

During surveys of the south-eastern areas of the Cape York Peninsula bioregion, a distinctive, unnamed, fourth species of this section was discovered and is described here. The initial collections of this *Drosera* were made by Muundhi and Juunju People in conjunction with CYPTRP botanist Simon Thompson and consultant botanist David Fell during biodiversity assessments of Muundhi, Juunju Daarrba Nhirrpan and Biniir National Parks (CYPAL). Discoveries like this highlight the importance of CYPTRP support and the exciting biodiversity within the Buubu Gujin Aboriginal Corporation lands. The engagement with the Traditional Owners in the field work and the naming of the plant provides confidence to indigenous people that their knowledge, skills and biodiversity are respected and secure within the CYPTRP program, and has value for the science community as a whole.

Materials and methods

This research is based on a study of herbarium specimens and associated spirit collection at BRI, and field studies at the type and single other currently known locality. All measurements have been made from live material or material preserved in spirit. Dimensions of measurements are inclusive, viz. 1.0–1.7 is given as 1–1.7.

Accepted for publication 24 February 2020

Field work was conducted in conjunction with the Department of Aboriginal and Torres Strait Islander Partnerships' Cape York Peninsula Tenure Resolution Program (CYPTRP) which has handed back over 3.7 million hectares of Cape York Peninsula to the Traditional Owners of the land. This area includes over 2.1 million hectares of National Park (Cape York Peninsula Aboriginal Land) (NP (CYPAL)). The program provides post handback support to Land Trusts and Aboriginal Corporations involved. Support projects include governance, natural resource management and biodiversity assessment.

Electron microscopy (Queensland University of Technology–Gardens Point, Brisbane, Qld, Australia) was performed and images captured by MTM using Zeiss Sigma VP Field Emission scanning electron microscope with an Oxford X-Max 50 Silicon Drift (SDD) EDS detector. Extra-high tension (EHT) voltage level in all cases was 5 kV, with a working distance of between 7.5 and 9.5 mm.

Taxonomy

Drosera buubugujin M.T.Mathieson **sp. nov.** with affinity to *D. schizandra*, but differing by the lateral inflorescence presentation, smaller flowers, shortly and thickly bilobed anther filaments, white to creamy white anthers and pollen, and predominantly oblanceolate to obovate leaf shape. **Typus:** Queensland. Cook District: Muundhi National Park (CYPAL), NNW of Cooktown, 19 August 2016, *M.T. Mathieson MTM2558, S. Thompson & S. Chapman* (holo: BRI [4 sheets + spirit]; iso: CNS *distribuendi*). [Exact locality withheld for conservation purposes].

Perennial herb with rosettes of mature individuals (7–) 10–26 (–30) cm in diameter with 4–12 active leaves, often asymmetrically arranged. Roots fleshy, terete, sparsely branched, covered with black-brown scales. Plantlets may form from the roots if these are damaged. Stipules somewhat triangular, laciniate, dissected, 1.5–2.5 mm long, positioned on the upper surface adnate to the leaf base. Leaves with petiole to 16 mm long when present, or sessile; lamina of mature (flowering or flowering-sized) plants semi-erect, decumbent or prostrate, oblanceolate or obovate (25–) 30–142 (–150) mm long, (10–) 12–38 (–40) mm at widest point, entire, bright dark green to yellowish-green depending on age and solar exposure. Adaxial lamina surface covered in translucent, white to pink trichomes (1.2–) 1.5–3.8 (–4.1) mm long, each with a distal, ellipsoid, red gland 0.2–0.5 mm long, producing copious quantities of mucilaginous digestive fluid when active; surface veins with extremely sparse (sometimes absent) eglandular or minutely glandular red hairs 0.1–0.3 mm long; mid vein prominent on both surfaces but more so on the abaxial surface; secondary venation more prominently raised on abaxial surface. Abaxial lamina surface veins with sparse, red, eglandular or minutely glandular hairs 0.2–1 mm long. Damaged or detached leaves may produce plantlets from the margins before decaying if somewhat adpressed to the substrate surface. Juvenile leaves, referring to the first few new leaves of plantlets formed during vegetative reproduction or potentially a seedling, to *c.* 20 mm long, distinctly petiolate with an orbicular to broadly oval lamina with the lamina usually only slightly longer than the petiole. Inflorescence a scorpioid cyme, 1–5 per rosette, variably 110–420 mm long, arising laterally from the leaf axils near the centre of the rosette, held semi-erect to horizontal, bearing 6–38 flowers spaced 4–14 mm apart. Peduncles 65–120 mm long covered in short, eglandular or minutely glandular hairs; bracts linear 1.5–2 mm long, largely glabrous, occasionally with a few eglandular hairs on the abaxial surface; pedicels 2.5–3.5 mm long, indumentum similar to peduncles. A plantlet consistently forms at the tip of the inflorescence as flowering completes (as in *D. prolifera*), resulting in largely clonal colonies. Sepals lanceolate, 2–3 mm long, 0.5–0.8 mm wide at base, becoming slightly wider at the

centre before tapering to an acuminate apex, margins entire, occasionally slightly undulate and, rarely, minutely ragged towards the apex, adaxial surface glabrous, abaxial surface with short hairs. Petals obovate, 2–2.5 mm long, 1.6–1.8 mm at widest point towards the apex, deep red-purple, margins entire, rarely a little undulate, apex minutely crenate to entire, often retuse to emarginate, becoming reflexed with age. Stamens 5 (–6), 1.2–1.5 mm long, reflexed; filaments red, widening in upper half becoming shortly and thickly bilobed; anthers and pollen white to creamy-white. Ovary obovoid, 0.65–0.8 mm long, 0.7–0.8 mm diameter at anthesis, yellowish-green to yellowish-pink. Styles 3 (–4), 0.2–0.25 mm long, bilobed, occasionally trilobed near apex, arms 0.15–0.2 mm long; pinkish-red lower half, white to yellowish white nearing truncate apex. Stigmas papillose. Seed[1] ovoid, tapered at the apices, *c.* 0.6 mm long and 0.4 mm wide, black, surface reticulate. **Figs. 1–3**.

***Additional specimens examined*: Queensland.** Cook District: Juunju Daarrba Nhirrpan NP (CYPAL), NNW of Cooktown, Dec 2015, *Thompson SLT15151 et al.* (BRI); *ibid*, Aug 2016, *Mathieson MTM2561 et al.* (BRI); Muundhi NP (CYPAL), NNW of Cooktown, Aug 2014, *Thompson SLT14659 & Fell* (BRI); *ibid*, Dec 2015, *Thompson SLT15127 et al.* (BRI).

***Distribution and habitat*:** *Drosera buubugujin* is endemic to the sandstone mesas and escarpments of Muundhi and Juunju Dhaarrba Nhirrpan National Parks (CYPAL), north north-west of Cooktown, north Queensland. The species grows on the banks of streams in gallery forest (**Fig. 4**) through sandstone gullies and ravines on sand and humus, generally amongst mosses. It has also been observed growing on sandstone cliffs and ledges where springs and seeps provide a constant water source. At times during the wet season, plants adjacent to streams would be inundated by flowing water, conceivably to a depth well above the height of the plant.

***Phenology*:** Flowers and fruits are recorded for August through to December.

***Affinities*:** *Drosera buubugujin* belongs to *Drosera* Section *Prolifera* and most closely resembles *D. schizandra*. It differs from *D. schizandra* by the following characters: Leaf shape widely variable, oblanceolate (predominantly) or obovate (vs. generally obovate in *D. schizandra*), flower diameter 4.5–5.5 mm (vs. 10–13 mm in *D. schizandra*), inflorescence emerging laterally, up to *c.* 400 mm long with up to 35 flowers (vs. generally erect, up to 150 mm long with up to 20 flowers in *D. schizandra*), anther filaments shortly and thickly bilobed (vs. deeply and widely bilobed (distinctly Y-shaped) in *D. schizandra*), pollen white-creamy white (vs. pollen yellow-orange in *D. schizandra*). Flowers of *D. buubugujin* and *D. schizandra* are shown in **Fig. 5** and **Fig. 6** respectively. The other species within *Drosera* section *Prolifera* are less like *D. buubugujin*, differing in the following ways: *D. prolifera* has a reniform leaf lamina with a distinct petiole at maturity while *D. adelae* has a narrowly lanceolate leaf lamina (vs. an oblanceolate, obovate or oblong-obovate leaf lamina that is barely or not petiolate in *D. buubugujin*); *D. adelae* had broadly lanceolate petals with an acuminate apex (vs. obovate petals in *D. buubugujin*).

[1] Note that only a single seed was found despite searching many tens of specimens

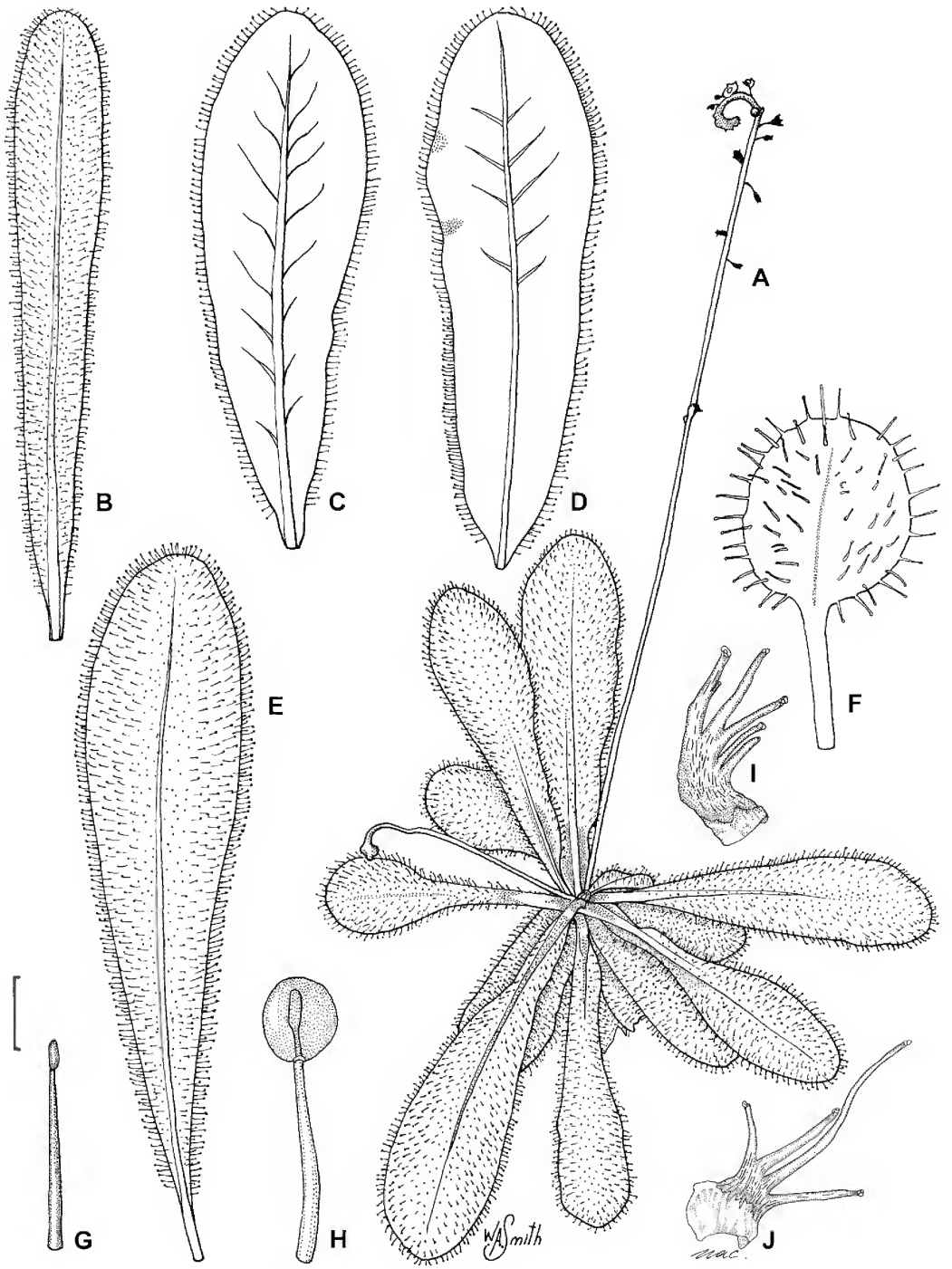

Fig. 1. ***Drosera buubugujin.*** A. whole plant ×0.6. B–E. mature leaves ×0.8. F. juvenile leaf ×4. G. glandular trichome without fluid ×16. H. glandular hair with fluid ×16. I. & J. stipules ×16. All from *Mathieson MTM2558 et al.* (BRI). Scale bar = 10 mm at ×1 magnification. Del. W. Smith and N. Crosswell.

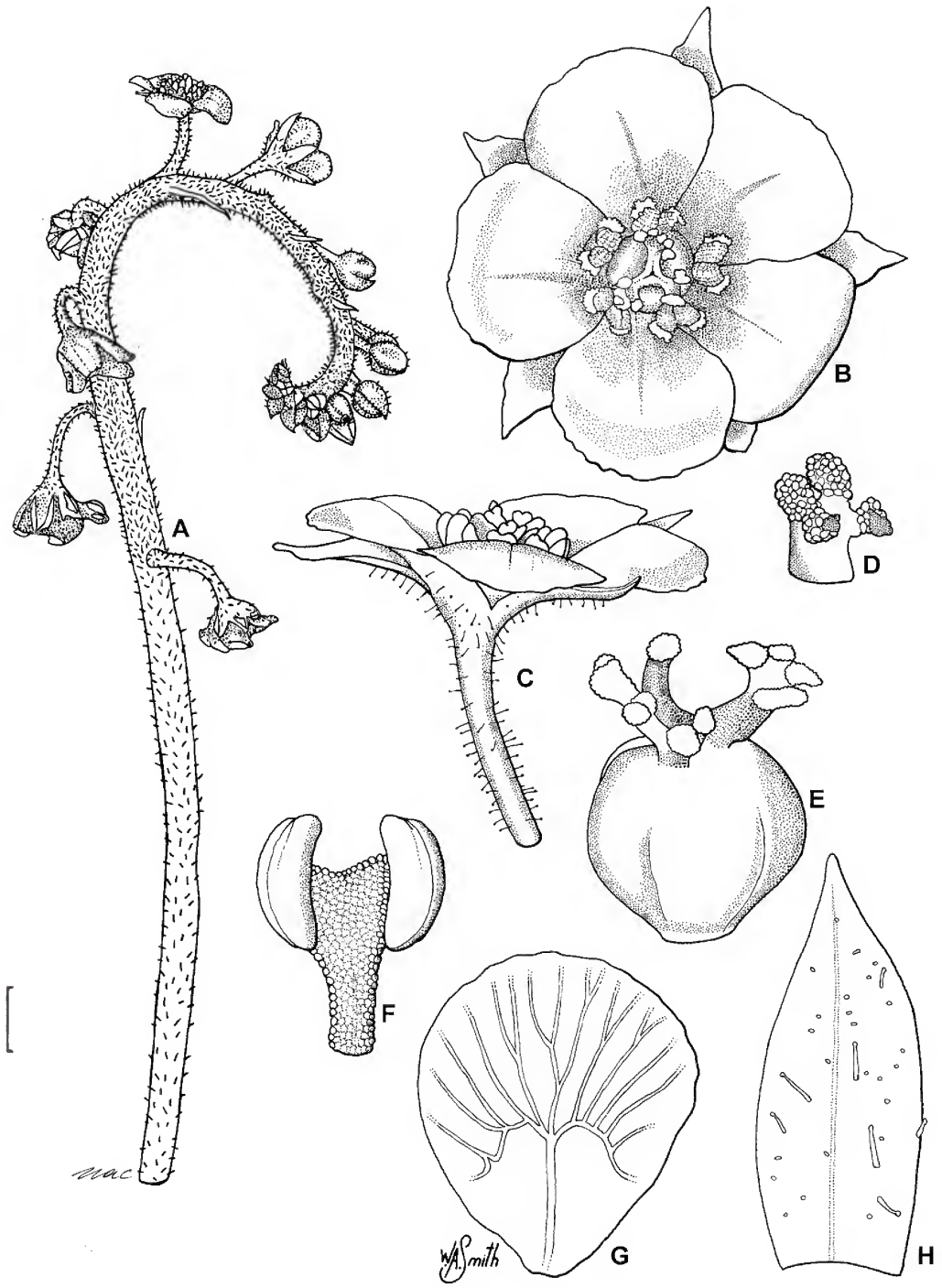

Fig. 2. *Drosera buubugujin.* A. inflorescence (in part) ×3. B. flower ×12. C. flower from the side ×12. D. style arm ×60. E. ovary and style ×36. F. anther ×36. G. petal ×24. H. sepal ×24. All from *Mathieson MTM2558 et al.* (BRI). Scale bar = 10 mm at ×1 magnification. Del. W. Smith and N. Crosswell.

A key to species in *Drosera* section *Prolifera*[2]

1 Mature leaf lamina lanceolate or reniform; abaxial surface of sepals glabrous **2**
1. Mature leaf lamina obovate, oblanceolate or oblong-obovate; abaxial surface of sepals with trichomes **3**

2 Mature leaf lamina reniform, distinctly petiolate . . . . . **D. prolifera**
2. Mature leaf lamina lanceolate . . . . . **D. adelae**

3 Mature leaf lamina generally obovate; inflorescence generally emerging and being held erect, rarely forming a plantlet at the distal tip; flowers 10–13 mm in diameter, petals 5–6.5 mm long; anther filaments deeply and widely bilobed (distinctly Y-shaped), pollen yellow-orange. . . . . **D. schizandra**
3. Mature leaf lamina oblanceolate (predominantly) or obovate; inflorescence emerging laterally and held semi-erect or horizontally, consistently forming a plantlet at the distal tip after flowering; flowers to 4.5–5.5 mm diameter, petals to 2–2.5 mm long; anther filaments shortly and thickly bilobed, pollen white to creamy white . . . . . **D. buubugujin**

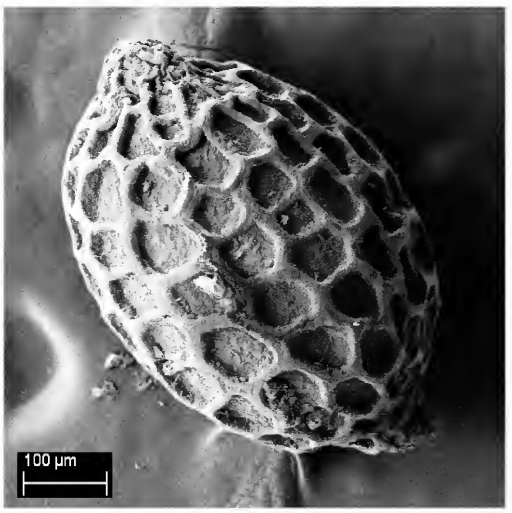

Fig. 3. Scanning electron microscope image of ***Drosera buubugujin*** seed (*Mathieson MTM2558 et al.*, BRI).

***Note*:** During the study of herbarium material for this work, a single seed was found on a specimen of *Drosera schizandra*, a feature not previously reported (Lowrie *et al.* 2017b). Despite some disfiguration due to the specimen drying process, this seed closely resembles that of *D. buubugujin* in size, shape and surface morphology.

***Conservation status*:** *Drosera buubugujin* is known from two locations within close proximity of one another; both within National Park (CYPAL) tenure. It has not been encountered elsewhere despite numerous further surveys in similar habitats since 2016 (H. Hines, *pers. comm.*; S.L. Thompson, *pers. obs.*). It is possible the species may occur elsewhere in the adjacent ranges given the potential extent of appropriate habitat that exists. However, all related species in the same section appear to have highly restricted ranges (Lowrie *et al.* 2017a,b). The distribution of these four species is shown in **Map 1**.

[2] Based on Lowrie (2013) and Lowrie *et al.* (2017a,b)

Fig, 4. ***Drosera buubugujin*** growing in habitat on a stream bank, Muundhi National Park. Photo: M.T. Mathieson.

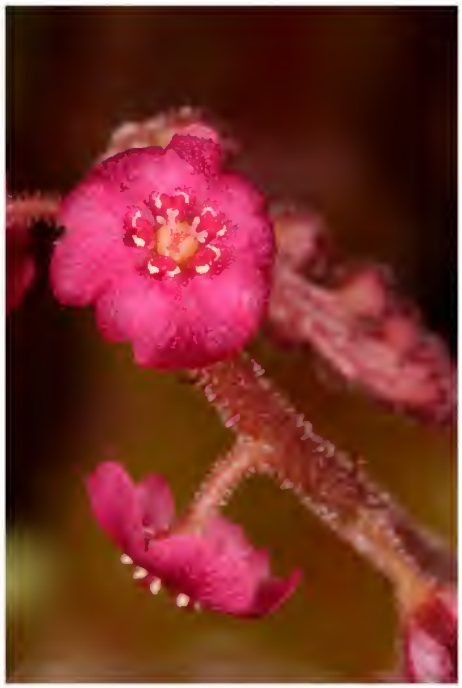

Fig. 5. Flowers of ***Drosera buubugujin***, Muundhi National Park, *c.* 5 mm in diameter. Photo: M.T. Mathieson.

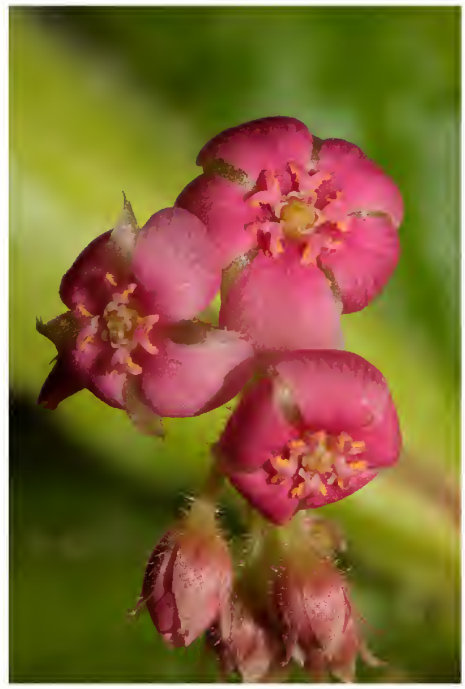

Fig. 6. Flowers of ***Drosera schizandra***, Wooroonooran National Park, *c.* 12 mm in diameter. Photo: M.T. Mathieson.

The population size at the type locality is difficult to estimate given the largely clonal nature of the species but is possibly between 500 and 1000 genetically distinct plants occupying an area of less than 0.5 hectare. The second population is smaller. Repeated fire events may threaten this species not only by directly destroying plants and the riparian habitat to which the species seems strictly bound, but also by encouraging the encroachment of introduced, hyperinvasive grasses (*viz.* giant rat's tail grass *Sporobolus pyramidalis* (Lam.) Hitchc., grader grass *Themeda quadrivalvis* (L.) Kuntze and gamba grass *Andropogon gayanus* Kunth), the rampant herbaceous weed *Praxelis clematidea* R.M.King & H.Rob. and lantana *Lantana camara* L. Applying criteria of the IUCN (IUCN 2012), the recommended conservation status is **Critically Endangered** (CR: **B1a, b(ii), (iii)** and **B2a, b(ii), (iii)**) due to small extent of occurrence and area of occupancy in conjunction with observed and inferred negative impacts of fire.

***Etymology*:** This species is named after the Buubu Gujin Aboriginal Corporation lands, which include Muundhi and Juunju Daarrba Nhirrpan National Parks (CYPAL) where it was collected.

Acknowledgements

The authors would like to thank the Buubu Gujin Traditional Owners for inviting us onto their lands and providing cultural guidance as well as the Buubu Gujin Corporation Directors for approving the use of the species name at Joint Management and Corporation meetings. Collections of this species were made in conjunction with the Traditional Owners of Muundhi and Juunju Daarrba Nhirrpan NPs (CYPAL). The following people and organisations are thanked for their assistance that made the survey possible: Debbie and Sally Chapman, Kieren Henderson and the Traditional Owners of the National Parks (CYPAL) that were surveyed; Ian McConnell (Department of Environment & Science, CYPTRP); QPWS rangers Chris Wall, Andy Baker & Janine White; Will Smith and Nicole Crosswell for the illustrations; David Fell, Ian Brown & Geoff Luscombe for support during surveys; Cheyne Fendon for helicopter services; and Gordon Guymer & David Halford (BRI) for logistical and field support.

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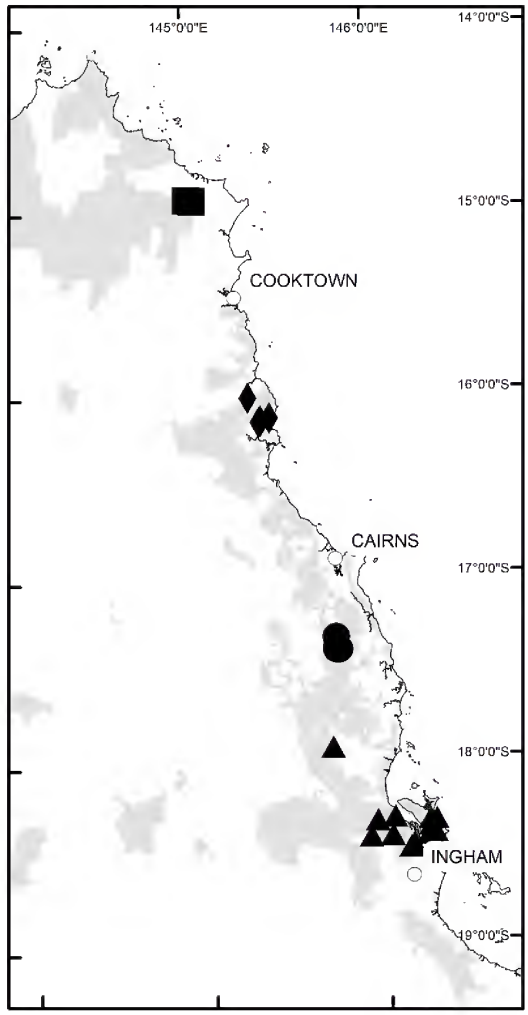

Map 1. Distribution of the four species of ***Drosera*** section ***Prolifera***. ***D. adelae*** ▲, ***D. buubugujin*** ■, ***D. prolifera*** ♦, ***D. schizandra*** ●. Protected areas are shaded.

Acacia lespedleyi P.I.Forst. (Mimosaceae), a new and geographically restricted species from south-east Queensland

Paul I. Forster

Summary

Forster, P.I. (2020). *Acacia lespedleyi* P.I.Forst. (Mimosaceae), a new and geographically restricted species from south-east Queensland. ***Austrobaileya* 10(4): 558–563**. The new species *Acacia lespedleyi*, with distinctive minni-ritchi bark, is described and illustrated. It is postulated to be allied to *Acacia curranii* Maiden and *A. rhodoxylon* Maiden. *Acacia lespedleyi* is known from two small subpopulations on an unusual substrate derived from duricrust and granite, west of Eidsvold in south-east Queensland and is considered to be Critically Endangered.

Key Words: Leguminosae; Mimosaceae; *Acacia*; *Acacia lespedleyi*; Australia flora; Queensland flora; taxonomy; new species; conservation status; critically endangered; duricrust

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Introduction

The genus *Acacia* Mill. is the most speciose genus in the Queensland vascular flora with over 300 species known, another ten having been recently described (Pedley 2019). As alluded to in that paper much taxonomic work remains, this relates not only to species circumscriptions, but to the testing of species groupings and the elucidation of the component taxa within.

The new species of wattle described in this paper (**Figs. 1–4**) was first collected during a botanical assessment of the property 'Telemark' west of Eidsvold in south-east Queensland in 2006. Although Les Pedley recognised the material as representing an undescribed species, it did not result in formal publication, so this is undertaken here with the species named in honour of Les.

The close affinities of *Acacia lespedleyi* P.I.Forst. are obscure, although it is clearly part of *Acacia* section *Juliflorae* (Benth.) C.Moore & Betche as applied by Pedley (1978) due to the plurinerved phyllodes and the flowers in spikes, and within the more broadly circumscribed *A.* section *Plurinerves* (Benth.) C.Moore & Betche (Pedley 1986). From a morphological perspective *A. lespedleyi* shows some similarities to particularly *A. curranii* Maiden and to a much lesser extent *A. rhodoxylon* Maiden, with all three species possessing 'minni-ritchi' bark to some degree (**Fig. 3**). This bark type (thin longitudinal pieces of bark that irregularly abscise from the stems and hang in untidy strips) is rarely encountered in wattle species outside of the arid zone in Queensland. In the *Flora of Australia* account *A. curranii* was included in Group 5, Subgroup 12 (Tindale & Kodela 2001) and *A. rhodoxylon* in Group 5, Subgroup 9 (Maslin 2001); although these groups have not been rigorously tested using molecular methods.

Materials and methods

The plant description in this paper is based on specimen collections at the Queensland Herbarium (BRI) and field observations by the author in 2006. Dimensions of measurements are inclusive, i.e. 1.0–1.7 is given as 1–1.7.

Accepted for publication 13 January 2020

Taxonomy

Acacia lespedleyi P.I.Forst., **sp. nov.** Similar to *A. curranii* but differing in the flattened phyllodes (versus linear and subterete) that are glabrous (versus pubescent), the basal gland being poorly developed and just above the pulvinus (versus well developed and well above the pulvinus), the glabrous flowers and pods (versus pubescent). **Typus:** Queensland. Burnett District: Telemark, 38 km W of Eidsvold, 9 February 2006, *P.I. Forster PIF31234* (holo: BRI [2 sheets]; iso: MEL).

Shrubs to 3 m tall; bark minni-ritchi, in short irregularly abscising longitudinal strips, red-brown, aging grey. Branchlets weakly angular towards apices, red-tan, waxy; young shoots resinous, glabrous. Phyllodes erect, linear and somewhat inequilateral with the upper margin weakly convex, coriaceous, flattened, 32–138 mm long, 2.5–5 mm wide; longitudinally striate with 24–28 non-anastomising veins including a weakly prominent midrib and 2 other equidistant veins (one per side of midrib), grey-green, waxy, glabrous; gland single, rudimentary, immediately above pulvinus; tip shortly apiculate, base attenuate; pulvinus 2–3 mm long, somewhat twisted, red-tan. Inflorescence spike a single continuous raceme, 12–15 mm long, 3–4 mm diameter; peduncles 2–3 mm long, glabrous, waxy. Flowers 5-merous, golden yellow; calyx ± continuous and truncate, slightly dissected for *c.* ¼ of length, papillose, glabrous; corolla 0.8–1 mm long, dissected for *c.* ½ of length with the lobes lanceolate-acute, 0.5–0.7 mm long and *c.* 0.05 mm wide, glabrous, glandular papillose on the margins and particularly at the apex; filaments 1–1.2 mm long, anthers *c.* 0.1 mm long; ovary papillose, glabrous. Pods linear, coriaceous, 1–5-seeded, 12–42 mm long, 1–2 mm wide, curved and often irregularly twisted, ± straight sided and slightly constricted between seeds, glabrous. Seeds not seen. **Figs. 1–3**.

***Additional specimens examined*: Queensland.** Burnett District: Telemark, 34 km W of Eidsvold, Mar 2006, *Forster PIF31360* (BRI); Telemark, 37 km W of Eidsvold, Mar 2006, *Forster PIF31353* (BRI); *ibid*, Mar 2006, *Forster PIF31357* (BRI); *ibid*, Sep 2006, *Rogers s.n.* (BRI [AQ814938]); 40 km W of Eidsvold, Telemark, Apr 2006, *Ritchie & Houschildt s.n.* (BRI [AQ614778]).

***Distribution and habitat*:** *Acacia lespedleyi* is known from a single location comprising two subpopulations about 2 km apart on the pastoral property 'Telemark', west of Eidsvold in the north Burnett district of south-east Queensland. The habitat is an open low forest (**Fig. 4**) dominated variously by *Allocasuarina inophloia* (F.Muell. & F.M.Bailey) L.A.S.Johnson, *Corymbia citriodora* (Hook.) K.D.Hill & L.A.S.Johnson, *C. trachyphloia* (F.Muell.) K.D.Hill & L.A.S.Johnson, *Eucalyptus cloeziana* F.Muell., *E. crebra* F.Muell., *E. exserta* F.Muell., *E. fibrosa* F.Muell. subsp. *fibrosa* and *Lysicarpus angustifolius* (Hook.) Druce on the unusual substrate of gravelly soil derived from a mixture of decomposing duricrust (Woolnough 1927, 1930; Dixon & McLaren 2009) and granite. These woodlands have a very sparse midstorey and understorey, mainly of perennial woody legumes and grasses.

***Phenology*:** *Acacia lespedleyi* has been collected in flower in September with old pods persisting at least until March. The pods collected to date all showed evidence of vertebrate predation, probably by parrots that are known to eat wattle seeds (Cameron 2007).

***Affinities*:** *Acacia lespedleyi* is postulated to be most closely allied to *A. curranii* with the nearest recorded populations for that species in shrubland on red sand, a good 160 km to the southwest. *Acacia curranii* is immediately distinct from *A. lespedleyi* by its strongly resinous and generally pubescent foliage, the linear, subterete (rarely flattened) phyllodes, the basal gland being well above the pulvinus and the heavily pubescent, ± straight pods. *Acacia lespedleyi* is not noticeably resinous (or only weakly so on the young shoots) nor with pubescent foliage and flowers, the phyllodes are flattened and the pods are curved and glabrous.

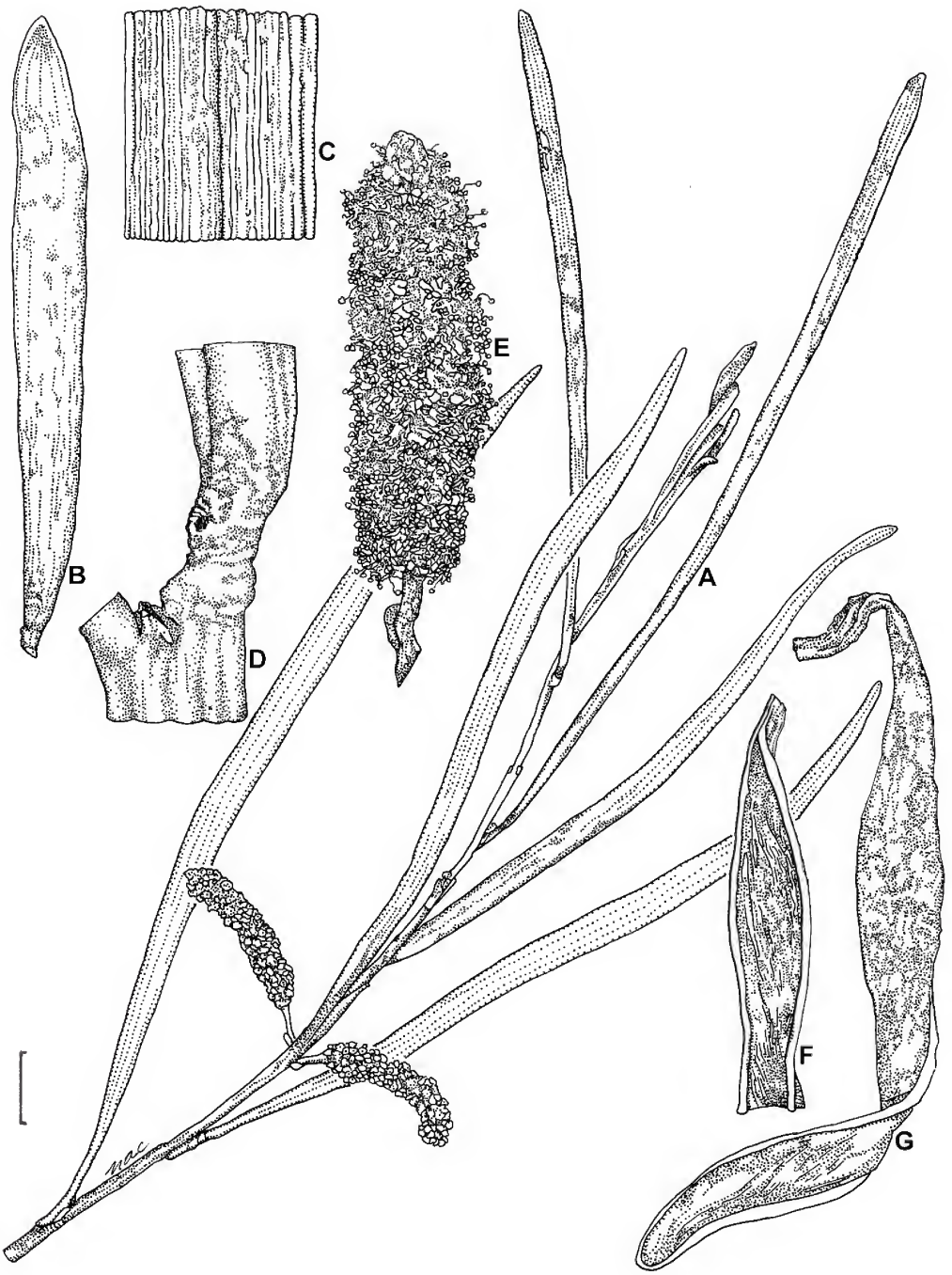

Fig. 1. ***Acacia lespedleyi***. A. habit of flowering branchlet ×2. B. single phyllode showing most obvious venation ×5. C. detail of phyllode venation ×10. D. base of phyllode at attachment to stem showing reduced pulvinus and poorly developed gland ×15. E. inflorescence ×5. F & G. views of dehisced pod ×5. A & E from ***Rogers s.n.*** (BRI [AQ814938]); B–D, F & G from *Forster PIF31353* (BRI). Scale bar = 10 mm at ×1 magnification. Del. N. Crosswell.

Fig. 2. Foliage of ***Acacia lespedleyi*** (*Forster PIF31234*, BRI). Photo: P.I. Forster.

Fig. 3. Bark of ***Acacia lespedleyi*** (*Forster PIF31234*, BRI). Photo: P.I. Forster.

Fig. 4. Habitat of ***Acacia lespedleyi*** (locality of *Forster PIF31234*, BRI). Photo: P.I. Forster.

Les Pedley suggested this species was also possibly allied to *Acacia rhodoxylon*; however, that species is very noticeably distinct in the elliptic to oblanceolate phyllodes and the narrowly oblong pods.

A further comparison can be made to *Acacia shirleyi* Maiden that is often found in similar environments further to the north and west; however, that species doesn't have minni-ritchi bark (being more stringy), has dissimilar phyllode venation (with only a primary midrib and no other prominent parallel side nerves), the inflorescence spikes are interrupted and much longer (15–60 mm long), and the calyx and ovary are noticeably pubescent.

***Notes*:** The occurrence of duricrust (a precipitated surface crust) is sporadic throughout the north Burnett and is sometimes associated with local speciation, examples being *Acacia forsteri* Pedley, *Boronia grimshawii* Duretto and *Zieria inexpectata* Duretto & P.I.Forst. Those three species are also known from single or few populations.

***Conservation status*:** Using the IUCN (2012) categories of conservation status, *Acacia lespedleyi* can be listed as **Critically Endangered** under the criteria **B1, B2 a, biii**. The species is known from one location with two subpopulations about 2 km apart that occupy less than 2 km^2 and was estimated to number less than 500 mature individuals

in 2006. The number of individuals varies depending on fire history in the habitat, although it is not known whether the species is able to withstand low intensity burns. While parts of the property 'Telemark' have been placed in a Nature Refuge, this does not include the two subpopulations of this *Acacia* with the habitat being managed for cattle production.

***Etymology*:** *Acacia lespedleyi* is named for Les Pedley (1930–2018), wattle specialist for many years at the Queensland Herbarium.

Acknowledgements

Thanks to Trevor Ritchie for facilitating visits to the localities, the late Les Pedley for discussion of this plant and to Nicole Crosswell for the illustrations.

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A taxonomic revision of *Camptacra* N.T.Burb. (Asteraceae: *Astereae*)

A.R. Bean

Summary

Bean, A.R. (2020). A taxonomic revision of *Camptacra* N.T.Burb. (Asteraceae: *Astereae*). ***Austrobaileya* 10(4): 564–575**. The genus *Camptacra* N.T.Burb. is taxonomically revised. Four species are recognised, including two newly named: *C. perdita* A.R.Bean and *C. robusta* A.R.Bean. A lectotype is chosen for *Eurybia gracilis* Benth. All species are fully described with notes on distribution (including maps), habitat and proposed conservation status. A key to the identification of all species is provided.

Key Words: Asteraceae; *Camptacra*; *Camptacra barbata*; *Camptacra gracilis*; *Camptacra perdita*; *Camptacra robusta*; New Guinea flora, Australia flora; new species; identification key; distribution maps

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Introduction

Camptacra N.T.Burb. is a small genus of herbaceous or low-shrubby daises. It belongs to the tribe *Astereae*, and is most closely related to *Vittadinia* A.Rich., *Peripleura* (N.T.Burb.) G.L.Nesom and *Tetramolopium* Nees (Lowrey *et al.* 2001). It can be distinguished from these genera by the slender, compressed shallowly-ribbed achenes that are often maroon or purplish when mature, the smooth receptacle, and by the frequent presence of a trifid apex on the leaves.

The genus was described by Burbidge (1982) with two species, *C. brachycomoides* (F.Muell.) N.T.Burb. and *C. barbata* N.T.Burb. These species she distinguished largely on the morphology of the involucral bracts. The author split *C. brachycomoides* into three "forms", based on the varying indumentum of the stems and leaves.

Lander (1987) published some new combinations after finding that the name *Eurybia gracilis* Benth. is referable to *Camptacra* and concluded that *C. gracilis* (Benth.) Lander and *C. brachycomoides* are synonymous. Despite Burbidge's comprehensive treatment of *Camptacra* (and related genera) and the small size of the genus, the identification of the constituent taxa has remained surprisingly difficult. This is partly because Burbidge's key to her two recognised species is difficult to use – it relies on interpretation of several qualitative characters of the capitulum and involucral bracts, and no other part of the plant is mentioned. Also, it seems likely that intergradation is occurring between three species in the genus (the rarely encountered *C. perdita* is the exception), and there appear to be few characters where discontinuities are evident. The net result has been general confusion about the identity of many *Camptacra* specimens.

Another complication has been the misapplication of the name *Olearia arguta* var. *lanata* Benth. in Queensland since the 1990s. This taxon is in fact endemic to the Northern Territory and Western Australia, and is characterised most easily by the dense glandular hairs on the leaves and peduncles, and the relatively large leaves. The Queensland plants that have gone under this name do not have any glandular hairs, and are merely a particularly hairy form of *Camptacra robusta*. Their generic status has

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been confirmed by two molecular studies on the phylogeny of Tribe *Astereae* (Lowrey *et al.* 2001; Cross *et al.* 2002).

Materials and methods

This study is based on an examination of herbarium specimens at the Queensland Herbarium (BRI), as well as material received on loan from CANB, DNA and MEL. High-quality images of type specimens from K and W have also been examined and are indicated as *i.d.v.* (*imago digitalis visa*).

Measurements made on the leaves, stems, peduncles and involucral bracts are based on dried material. Measurements of floral parts are based on material preserved in spirit, or reconstituted with boiling water. Dimensions are inclusive, i.e. 1–1.7 indicates 1.0–1.7.

In the specimen citations, abbreviations include Mt (Mountain or Mount) and NP (National Park).

Taxonomy

Camptacra N.T.Burb., *Brunonia* 5: 11 (1982). **Type:** *C. brachycomoides* (F.Muell.) N.T.Burb.

Perennial shrubs or herbs, stems ribbed, woolly hairs frequent, glandular hairs uncommon. Leaves alternate, sessile, entire or with short lobes, apex usually acute to apiculate, but a minority of leaves with apex trifid; sessile glands uncommon. Peduncles longer than the leaves, bearing a single capitulum; involucral bracts 3–5-seriate; receptacle convex, smooth, epaleate; all florets fertile. Ray florets in 1–2 rows, female, conspicuously ligulate; glabrous except for sparse antrorse eglandular or glandular hairs near junction of tube and ligule; style 2-branched, not conspicuously swollen at base but set into an erect nectary disc. Disc florets actinomorphic, hermaphrodite and fertile, 5-merous, narrowly funnelform; staminal filaments attached at or below middle of corolla tube; anther apices lanceolate or trullate; stigmatic appendages linear to ellipsoidal, coarsely papillose. Achenes linear, laterally flattened, with 3–7 longitudinal ribs. Pappus 1–2-seriate, bristles with pectines only *c.* 0.025 mm long, scarcely visible at 40× magnification.

Four species in northern Australia with one extending to Papua New Guinea.

A key to the species of *Camptacra*

1 Leaves 4.5–15 mm wide (excluding marginal teeth); capitula 8–12 mm long and 13–21 mm across; marginal floret (including ligule) 10–15 mm long; peduncles 0.8–1.5 mm diameter at midpoint; inner involucral bracts 6–7.5 mm long . . . . . **4. C. robusta**

1. Leaves 1.1–5 mm wide (excluding marginal teeth); capitula 5–8 mm long, 8–14 mm across; marginal floret (including ligule) 5–12 mm long; peduncles 0.4–0.8 mm diameter at midpoint; inner involucral bracts 3.5–6 mm long **2**

2 Glandular hairs abundant on outer involucral bracts; corolla lobes of disc floret glandular-hairy . . . . . **3. C. perdita**

2. Glandular hairs absent from involucral bracts; corolla lobes of disc floret glabrous **3**

3 Leaves glabrous or sparsely hairy, all leaves with acute apex or a few with trifid apex; terminal part of inner involucral bracts glabrous or with ciliate margins; receptacle 1.3–3.5 mm diameter. . . . . **2. C. gracilis**

3. Leaves sparsely to densely hairy, numerous leaves with trifid apex; cluster of hairs usually present on terminal part of inner involucral bracts (inner surface); receptacle (2.5–) 3–6 mm diameter . . . . . **1. C. barbata**

1. Camptacra barbata N.T.Burb., *Brunonia* 5: 15 (1982). **Type:** Queensland. Moreton District: Dinmore, near Ipswich, 29 October 1960, *L. Pedley 726* (holo: CANB; iso: BRI).

Camptacra brachycomoides f. *arachnoidea* N.T.Burb., *Brunonia* 5: 14 (1982); *C. gracilis* f. *arachnoidea* (N.T.Burb.) Lander, *Nuytsia* 6: 61 (1987). **Type:** Queensland. North Kennedy District: Rockingham's Bay, *s.dat.*, *J. Dallachy s.n.* (holo: MEL 1004261).

Erect herb to 50 cm high. Stems glabrous or sparsely to densely woolly-hairy. *Leaves* linear, 18–55 mm long, 1.4–5 mm wide excluding marginal teeth, glabrous or woolly, glands absent; apex acute, apiculate or rarely to frequently trifid; base narrowly to broadly cuneate; margins entire or with a few teeth up to 2 mm long, more or less evenly distributed; midrib obvious and sometimes 2 additional parallel veins evident. *Capitula* 5–8 mm long, 8–14 mm diameter. Peduncles 5–12 cm long, 0.4–0.8 mm wide at midpoint, with sparse woolly hairs confined to upper part or densely woolly throughout. *Involucral bracts* 24–36, graduated in length; outer bracts narrowly ovate, 1.6–3.1 mm long, glabrous or with sparse woolly hairs on outer surface, apex acute; inner bracts narrowly lanceolate, 3.5–5.5 mm long, usually with dense tuft of hairs near apex, apex acute to obtuse. *Receptacle* (2.5–) 3–6 mm across. *Ray florets* 25–48, corolla tube 2.2–3.5 mm long, glabrous except for sparse antrorse eglandular hairs near junction of tube and ligule; tube + ligules 5–12 mm long, white, apex obtuse or minutely notched. *Disc florets* 30–68, yellow, corolla tube 3.3–4.2 mm long, glabrous except for sparse antrorse hairs near the midpoint; corolla lobes 0.4–0.6 mm long, deltate, glabrous. *Achenes* 2.2–3.1 mm long, maroon or purplish when mature, glabrous or with sparse antrorse hairs on upper half. *Pappus* bristles 24–30 in number, each 2.6–4.5 mm long.

***Additional selected specimens examined*: Northern Territory.** Daguragu Land Trust area, S of Gill Creek, *c.* 51 km NW of Kalkarindji, Mar 2012, *Cowie 12973* (DNA); Mt Sanford, Threeways holding paddock, Aug 2000, *Brock 118* (CANB, DNA). **Queensland.** Cook District: Metal Hills section, Chillagoe – Mungana Cave NP, Jan 2005, *Little LL36* (BRI). North Kennedy District: Lolworth Creek, N of Charters Towers, Nov 1985, *Jackes 12* (BRI); 2.5 km S of "Doongara", Mar 1988, *Forster PIF3729 & Bolton* (BRI); 13 km N of Burdekin Falls, on Burdekin Falls – Mingela road, Apr 1990, *Jobson 1119* (BRI, CANB, MEL). South Kennedy District: *c.* 6 km due SE of Strathmore Station, along road to Collinsville, Mar 2003, *Pollock ABP1690 & Edginton* (BRI); 16.4 km W of Oxenhope Outstation, May 1991, *Neldner 3240 & Thompson* (BRI). Mitchell District: 18 km ENE of Prairie, on Flinders Highway, Mar 1993, *Thompson HUG320 & Henderson* (BRI). Leichhardt District: Uncle Toms Road, SE of Moura, Sep 1999, *Bean 15331* (BRI, MEL). Warrego District: Morven, Apr 1936, *Blake 10985* (BRI). Maranoa District: Beside airstrip, Mt Moffatt NP, NW of Injune, Oct 1998, *Bean 14285* (BRI); 24 km NE of Roma, Apr 2003, *Baumgartner 3371-6* (BRI). Burnett District: *c.* 8 km NW of 'Rawbelle', W of Monto, Jun 1996, *Bean 10383* (BRI, MEL); 2 km S of Derrabungy Creek Bridge, S of Mundubbera, Nov 1997, *Bean 12590* (BRI, MEL); Monto – Mt Perry Road, 0.5 km W of Yarrol Road turnoff, Mar 2013, *Bean 32112* (BRI, CANB, MEL, US). Darling Downs District: Road to Kupunn, 1 km from the Moonie Highway turnoff, 16 km SW of Dalby, Oct 1996, *Lowrey 1751* (BRI); Jondaryan cemetery, Apr 1994, *Fensham 1688* (BRI, MEL). Moreton District: Grounds of TAFE college, Byrne Street, Bundamba, Oct 2007, *Bird s.n.* (BRI [AQ745021]); Boonah, S of Ipswich, Nov 1934, *Michael 2093* (BRI). **New South Wales.** 3 miles [5 km] E of Inverell, Jun 1955, *Jessup & Gray 2800* (CANB); 1 mile [1.6 km] N of Howell, Jun 1955, *Jessup & Gray 2784* (CANB); Travelling Stock Route, 5.5 km N of Warialda on road to Yetman, Oct 1993, *Prober s.n.* (CANB 00500874).

***Distribution and habitat*:** *Camptacra barbata* is widely distributed in the eastern half of Queensland, and in the Victoria River district of Northern Territory. It also extends into northern New South Wales, west of the Great Dividing Range (**Map 1**). It is found almost exclusively on plains in grassland or open woodland, with heavy dark-brown to black cracking clay soil.

***Phenology*:** Flowers and fruits have been recorded for every month of the year.

***Affinities*:** *Camptacra barbata* appears to be closely related to *C. gracilis* (see Affinities under that species).

***Notes*:** Burbidge (1982) distinguished *Camptacra barbata* from *C. brachycomoides* (= *C. gracilis*) by the 'hemispheric' mature capitulum (vs. campanulate for *C. gracilis*) and the 'subglobose budding heads' (vs. 'campanulate bud' for *C. gracilis*); the sub-apical colouration on the inner involucral

bracts (vs. uniformly coloured for *C. gracilis*); and the woolly hairs on the inner face of the involucral bracts at the distal end (vs. woolly hairs absent for *C. gracilis*). I cannot discern any consistent difference in the capitulum shape between specimens determined by Burbidge as *C. barbata* or *C. brachycomoides*, and all *Camptacra* specimens have subglobose budding heads at the earliest stage. The subapical colouration of the bracts is apparent on some specimens that Burbidge labelled *C. barbata* (particularly those from far south-eastern Qld), but not on others. The 'woolly hairs on the inner surface of the bracts' character does appear to be a useful character for *C. barbata*, though not universally present.

***Conservation status*: Least Concern** (IUCN 2012). While the habitat of this species has undoubtedly been reduced over the last century, it is a common species with a very large geographical range, occurring in numerous conservation reserves.

2. Camptacra gracilis (Benth.) Lander, *Nuytsia* 6: 61 (1987); *Eurybia gracilis* Benth., *Enum. Pl. [Endlicher]* 59 (1837); *Camptacra gracilis* (Benth.) Lander f. *gracilis*, *Nuytsia* 6: 61 (1987). **Type:** Nova Hollandia, *s.dat.*, *F. Bauer s.n.* (lecto: W 0047219 *i.d.v.* [here designated]; probable isolecto: K 000890338 *i.d.v.*).

Aster brachycomoides F.Muell., *Fragm.* 5: 86 (1865); *Vittadinia brachycomoides* (F.Muell.) Benth., *Fl. Austral.* 3: 490 (1867); *Camptacra brachycomoides* (F.Muell.) N.T.Burb., *Brunonia* 5: 12 (1982); *Camptacra brachycomoides* f. *brachycomoides*, N.T.Burb., *Brunonia* 5: 13 (1982). **Type:** Arnhem's Land, 14 July 1856, *F. Mueller s.n.* (lecto: MEL 1004273, *fide* Burbidge (1982: 13); isolecto: K 000890337 *i.d.v.*).

Erect herb to 40 cm high. Stems glabrous or sometimes sparsely woolly-hairy. *Leaves* linear, 26–50 mm long, 1.1–2.5 mm wide excluding marginal teeth, glabrous, glands absent; apex acute or occasionally trifid; base narrowly cuneate to attenuate; margins entire or with a few teeth up to 0.7 mm long, more or less evenly distributed; midrib obvious but all other venation obscure. *Capitula* 5.5–7 mm long, 9–11 mm diameter. Peduncles 4.5–14 cm long, 0.4–0.6 mm wide at midpoint, glabrous throughout or with sparse woolly hairs on upper part. *Involucral bracts* 26–40, graduated in length, outer bracts narrowly ovate, 1.8–3.3 mm long, glabrous or with sparse woolly hairs on outer surface, apex acute to acuminate; inner bracts narrowly lanceolate, 3.5–4.5 mm long, glabrous throughout or with ciliate margins on upper part, apex acute to acuminate. *Receptacle* 1.3–3.5 mm across. *Ray florets* 20–42, corolla tube 2–2.7 mm long, glabrous except for sparse antrorse eglandular hairs near junction of tube and ligule; tube + ligules 6–11 mm long, white and becoming pink with age, apex obtuse or minutely notched. *Disc florets* 28–66, yellow, corolla tube 3.2–4.2 mm long, glabrous except for sparse antrorse hairs near the midpoint; corolla lobes 0.5–0.65 mm long, deltate, glabrous. *Achenes* 2.3–3.7 mm long, maroon or purplish when mature, glabrous or with sparse antrorse hairs on upper half. *Pappus* bristles 24–30 in number, each 2.6–4.2 mm long.

***Additional selected specimens examined*: Northern Territory.** Emu Springs, central Arnhem Land, Sep 1999, *Cowie 8446 & Dunlop* (BRI); *c.* 10 km N of the Mainoru River towards Bullman Station from Mainoru Station, May 1974, *Pullen 9373* (CANB); 100 km SE of Nhulunbuy, Arnhem Land, Sep 1985, *Wightman 2239* (CANB). **Queensland.** Cook District: Brooklyn, near Rifle Creek/Luster Creek junction, Jan 1996, *Godwin MGC4201 & Russell* (BRI); Blackbraes NP, Dec 2010, *McDonald KRM10250 & Jensen* (BRI, CANB); 1 km N of Lakeland beside the Cooktown Road, Feb 2001, *Wannan 2162* (BRI); 16.5 km N of Mareeba Post Office, on Mt Molloy Road, Dec 1993, *Neldner 4126 & Milne* (BRI). North Kennedy District: 40 miles [64 km] S of Ayr, on W bank of Burdekin River, Feb 1963, *Seton 27* (BRI); "Etonvale", WSW of Bowen, May 1992, *Bean 4543* (BRI); near Gumlu, Oct 1950, *Blake 18633* (BRI); 50 km S of Mt Garnet, May 1999, *Wannan 1235 & Jago* (BRI); Wambiana Station, 70 km S of Charters Towers, Jun 1998, *O'Reagain 729* (BRI). South Kennedy District: Red Hill Station, 79.5 km SSW of Charters Towers, Apr 2006, *Thompson CHA705 & Wilson* (AD, BRI). Port Curtis District: Broad Sound, Sep 1802, *Brown s.n.* (CANB); Marlborough serpentinite landscape, May 2010, *Hendry 744/7* (BRI); 2 km NW of Seahound Hard boat ramp, Shoalwater Bay Training area, N of Yeppoon, Feb 2012, *Bean 31609 & Mathieson* (BRI, L, MEL, NY, P); 7.5 km from Bruce Highway at Bajool, towards Port Alma, Apr 2012, *Bean 32009* (BRI, CANB, DNA, E, MO, W); The Springs, Shoalwater Bay Military Area, N of Rockhampton, May 2014, *Halford QM1496* (BRI); S end of Duck Lagoon, South Percy

Island, Mar 1906, *Tryon s.n.* (BRI [AQ246175]); Mt Bonnie Doon, Rockhampton – Marlborough area, Jan 1989, *Specht 210 & Reeves* (BRI); Old Byfield Road, near Pine Mountain, May 1996, *Plumb JP4* (BRI); Clinton Lowlands, Freshwater sector, Shoalwater Bay Training Area, N of Yeppoon, Apr 2016, *Halford QM2078 & Mathieson* (B, BM, BRI, CANB, DNA, HO, NSW, PRE, US).

***Distribution and habitat*:** *Camptacra gracilis* occurs in the north-east of the Northern Territory (eastern Arnhem Land) and in Queensland, where it extends from Lakeland Downs to south of Gladstone, and usually less than 200 km from the coast (**Map 2**). In coastal areas, it inhabits marine plains in association with, or near to, *Sporobolus virginicus* (L.) Kunth. Elsewhere it grows in ephemeral swamps, in heavy soil with native *Dichanthium* grassland, or in mixed eucalypt woodland. It has also been recorded from soils derived from serpentinite.

***Phenology*:** Flowers are recorded from October to June; fruits are recorded from November to May.

***Typification*:** The sheet at W is chosen as the lectotype for *Eurybia gracilis* Benth. as it is the only known Bauer specimen matching the protologue that was seen by Bentham before the date of publication. The specimen at K was received in 1854, and has somewhat broader leaves, but is probably part of the same gathering.

***Affinities*:** *Camptacra gracilis* is closely related to *C. barbata*, and some collections are difficult to place. *C. gracilis* lacks the tuft of hairs on the apex of the involucral bracts, and it generally has narrower leaves, glabrous leaves and stems, a smaller receptacle, and few or no leaves with a trifid apex.

***Notes*:** From the date of collection of *Aster brachycomoides*, it can be inferred that Mueller collected it near present-day Mataranka, at the south-western extent of the range of *C. gracilis* in the Northern Territory. Specimens collected further south and west are a closer match for *C. barbata*.

It is not known where Ferdinand Bauer collected the type material for *Eurybia gracilis*, but the type matches material collected by Robert Brown from "Broad Sound" and labelled *Eurybiopsis macrorrhiza* DC., and both are very similar to some recent collections from the Shoalwater Bay Training Area in Queensland (cited above).

***Conservation status*: Least Concern** (IUCN 2012). While the habitat of this species has been reduced over the last century, it is a common species with a large geographical range. It occurs in at least two National Parks.

3. Camptacra perdita A.R.Bean **sp. nov.** Differing from *C. barbata* by the white densely-woolly hairy stems, the glandular-hairy involucral bracts, the consistently unlobed leaf apex, and the smaller capitula and florets. **Typus:** Queensland. Darling Downs District: Oakey rail line, southern side of Oakey, Cutella Road, 22 November 2001, *I.L. Menkins ILM0074* (holo: BRI; iso: DNA).

Erect herb to 35 cm high. Stems very densely woolly-hairy, snowy white. *Leaves* narrowly-elliptical to oblanceolate, 14–24 mm long, 2–5 mm wide, sparsely woolly-hairy throughout, glands absent; apex acute, never trifid; base narrowly cuneate to attenuate; margins occasionally entire but usually with 2–4 pairs of teeth up to 1.2 mm long, more or less evenly distributed; midrib obvious but all other venation obscure. *Capitula* 4–5.5 mm long, 7–9.5 mm diameter. Peduncles 3–7 cm long, 0.4–0.6 mm wide at midpoint, sparsely woolly-hairy throughout, and with dense stalked glandular hairs on upper part. *Involucral bracts* 30–36, graduated in length, outer bracts narrowly ovate, 1.3–1.8 mm long, with dense glandular hairs on outer surface, apex acute to obtuse; inner bracts narrowly elliptic, 2.7–3.4 mm long, sparsely glandular-hairy throughout and with ciliate margins on upper part, apex acute to obtuse. *Receptacle* 1–1.5 mm across. *Ray florets* 20–30, corolla tube 1.3–1.5 mm long, glabrous except for sparse antrorse stalked glandular hairs near junction of tube and ligule; tube + ligules 4–6 mm long, white to light mauve, apex obtuse or minutely notched. *Disc florets* 19–29, yellow, corolla tube 2.9–3.3 mm long, glabrous; corolla lobes *c.* 0.6 mm long, deltate, with stalked glandular hairs on outer surface. *Achenes* 2.5–2.7 mm long, brown when

mature, with moderately dense antrorse hairs throughout, and with scattered glandular hairs. *Pappus* bristles 23–28 in number, each 2.7–3.5 mm long. **Fig. 1**.

***Additional specimens examined*: Queensland.** Maranoa District: Bungegorgoral Stock Route, NW of Howard, Oct 2017, *Fensham 6812* (BRI); 7 km W of St George, Sep 1973, *Trapnell & Williams 287* (BRI). Darling Downs District: Warrego Highway near Oakey, Mar 2013, *Fensham 6344* (BRI). **New South Wales.** North Western Plains: Kirramingly Nature Reserve, *c.* 30 km SSW of Moree, 2.5 km WSW of Kirramingly Homestead, May 2010, *Copeland 4440* (BRI; CANB, K, MEL, NSW, PERTH, all *n.v.*)

***Distribution and habitat*:** *Camptacra perdita* is known from four collections in southern Queensland (two from near Oakey, one near St George and one near Roma), and from a single location in New South Wales (**Map 2**). It is recorded growing in grassland on heavy black soil on alluvium, at least two sites dominated by *Dichanthium sericeum* (R.Br.) A.Camus.

***Phenology*:** Flowers and fruits are recorded for March, May, September, October and November.

***Affinities*:** *Camptacra perdita* differs from its closest relative *C. barbata* by the white densely-woolly hairy stems, the glandular-hairy involucral bracts, the consistently unlobed leaf apex, and the capitula 4–5.5 × 7–9.5 mm (5–8 × 8–14 mm for *C. barbata*), and the corolla tube of the disc florets 2.9–3.3 mm long (3.3–4.2 mm long for *C. barbata*).

***Notes*:** This is the only species of *Camptacra* with glandular hairs; they are most obvious on the involucral bracts and upper part of the peduncle, but are also found on the corolla lobes of the disc florets and on the achenes. The contrast between the densely hairy snowy-white stems and the sparsely-hairy green leaves is also diagnostic.

***Conservation status*:** The habitat of *Camptacra perdita* (grassland on fertile cracking clays) has been extensively utilised for cropping and grazing for over a century, and the few collections suggest that it is threatened. A status of **Endangered** (IUCN 2012) is recommended, criterion **B2ab(iii)**.

***Etymology*:** From the Latin *perditus*, meaning 'lost' or 'abandoned'. This alludes to the species co-existing with, but being vastly outnumbered by *Camptacra barbata*.

4. Camptacra robusta A.R.Bean **sp. nov.** With affinity to *C. barbata*, but differing by the longer and broader capitula, the wider leaves, the thicker peduncles and the longer involucral bracts. **Typus:** Queensland. North Kennedy District: Kennedy Highway, *c.* 12 km W of Ravenshoe, 11 December 2000, *R.L. Jago 5792 & B. Wannan* (holo: BRI; iso: DNA, US).

Vittadinia brachycomoides var. *latifolia* Benth., *Fl. Austral.* 3: 490 (1867). **Types:** [Queensland. Cook District:] Albany Island, Cape York, 25 October 1849, *J. Macgillivray s.n.* (syn: K 000890335 *i.d.v.*); [Queensland.] Rockingham Bay, *s.dat.*, *J. Dallachy s.n.* (syn: K 000890334 *i.d.v.*).

Camptacra brachycomoides f. *lanata* N.T.Burb., *Brunonia* 5: 14 (1982); *Camptacra gracilis* f. *lanata* (N.T.Burb.) Lander, *Nuytsia* 6: 61 (1987). **Type:** Queensland. Burke District: Near source of Poison Creek, *c.* 90 miles [145 km] N of Hughenden, 11 April 1935, *S.T. Blake 8545* (holo: BRI).

[*Olearia arguta* var. *lanata, auct. non* Benth., Queensland populations; Britten (1901: 249)].

***Illustration*:** Britten (1901: t. 153) [as *Olearia arguta*].

Erect or procumbent herb or shrub to 50 cm high. Stems sparsely to densely woolly-hairy. *Leaves* linear to narrowly-elliptic, 22–55 mm long, 4.5–12 mm wide excluding marginal teeth, sparsely to densely woolly, glands absent; apex acute, apiculate, or rarely to frequently trifid; base broadly cuneate to obtuse; margins entire or with a few teeth up to 4 mm long, more or less evenly distributed; midrib and 2 additional parallel veins prominent. *Capitula* 8–12 mm long, 13–21 mm diameter. Peduncles 5–25 cm long, 0.8–1.5 mm wide at midpoint, sparsely to densely woolly throughout. *Involucral bracts* 28–36, graduated in length; outer bracts narrowly ovate, 1.8–4 mm long, with sparse woolly hairs on outer surface, apex acute;

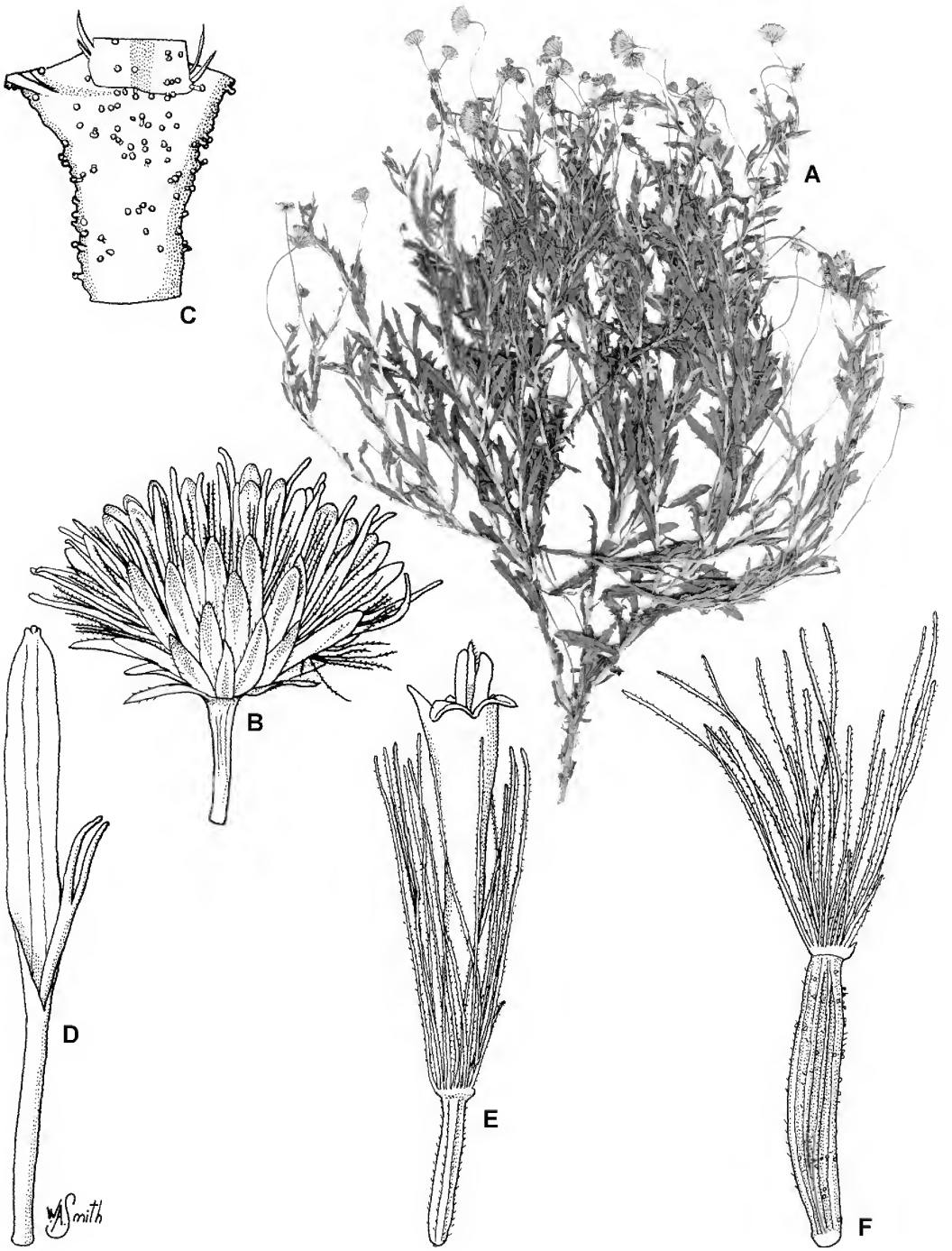

Fig. 1. ***Camptacra perdita***. A. whole plant ×0.5. B. flowering capitulum, lateral view ×5. C. uppermost section of peduncle, showing glandular hairs ×32. D. ligulate floret ×16. E. disc floret, pappus and immature achene ×16. F. mature achene with pappus ×16. All from *Menkins ILM0074* (BRI). Del. W. Smith.

inner bracts narrowly lanceolate, 6–7.5 mm long, glabrous or shortly ciliate, apex acute to obtuse. *Receptacle* 4–6.2 mm across. *Ray florets* 36–60, corolla tube 3–3.5 mm long, glabrous except for sparse antrorse eglandular hairs near junction of tube and ligule; tube + ligules 10–15 mm long, white to lilac, apex obtuse or minutely notched. *Disc florets* 52–78, yellow, corolla tube 4.2–4.6 mm long, glabrous except for sparse antrorse hairs near the midpoint; corolla lobes 0.4–0.6 mm long, deltate, glabrous. *Achenes* 2.9–4 mm long, maroon or purplish when mature, glabrous or with sparse antrorse hairs on upper half. *Pappus* bristles 25–34 in number, each 4.7–5.2 mm long. **Fig. 2**.

***Additional selected specimens examined*: Papua New Guinea.** Morobe Province: Karmanuntina River valley, near Habaya, Goroka subdistrict, Sep 1957, *Robbins 916* (CANB). Central Province: Astrolabe Range, Jul 1918, *White 245* (BRI); Aiyura, Oct 1944, *Smith NGF1147* (BRI). **Queensland.** Cook District: Piccaninny Plain turnoff near Bamaga – Weipa Road junction, Oct 2008, *McDonald KRM8005 & Winter* (BRI); Lizard Island, May 1975, *Byrnes 3171* (BRI); Undara NP, Yaramulla ranger base, Dec 2004, *McDonald KRM3234* (BRI); *c.* 1 km S of Bailey Point, Jun 2003, *Jago 6499* (BRI); *c.* 30 miles [48 km] W of Cardwell, Nov 1967, *Boyland 573* (BRI); 4 km S of Mareeba, on the Kennedy Highway, Dec 1983, *Clarkson 5073* (BRI, CANB, CNS, DNA); 7.1 km by road W of Petford, Jan 2008, *McDonald KRM7126 & Ford* (BRI); Newcastle Range, 29.5 km by road E of Forsayth, Feb 2013, *McDonald KRM13816* (BRI). Burke District: Blackbraes NP, Mar 2003, *Kemp TH7040 & Cutt* (BRI). North Kennedy District: Herberton, *s.dat.*, *Kenny s.n.* (BRI [AQ246199]); 116 km from Kennedy on Mt Garnet Road, Jan 1992, *Forster PIF9512* (BRI, MEL); Mt Fox crater, Seaview Range, Apr 1985, *Rodd & Hardie 4461* (BRI, NSW); *c.* 0.6 km from junction of Kennedy Highway and Gulf Development Road, towards Mt Surprise, Dec 2004, *McDonald KRM3151 et al.* (BRI, NSW); End of Deception Creek Road, Mt Zero/Taravale Wildlife Sanctuary, Dec 2011, *Jensen 2539* (BRI); 2 km N of Burra microwave tower, Feb 1994, *Bean 7491 & Forster* (BRI); Mt Abbot, 50 km W of Bowen, Aug 1992, *Bean 4852* (BRI). South Kennedy District: 'Glen Innes', NW of Alpha, Jul 2003, *Fensham 4888* (BRI); *c.* 35 km SE of Lake Buchanan, Jun 1998, *Thompson BUC2084* (BRI). Mitchell District: Moorinya NP, 17.6 km NW of ranger station, May 2006, *Thompson TAN449 & Wilson* (BRI); 20 km SE of Muttaburra on Aramac Road, Apr 2012, *Silcock JLS1177* (BRI). Leichhardt District: Near Station Creek, 0.5 km W of Arcturus Downs, E of Springsure, Oct 1998, *Bean 13992* (BRI); Peak Downs, Jun 1951, *Everist 4404* (BRI).

***Distribution and habitat*:** *Camptacra robusta* occurs in northern Queensland, from Springsure to Cape York, and in Papua New Guinea (**Map 3**). In Queensland, it prefers basaltic plains with red to brown clayey soil, but also occurs on plains with red sandy soils, and on sandstone slopes, all in eucalypt woodland. For Papua New Guinea, the habitat is merely stated to be "grassland".

***Phenology*:** Flowers and fruits have been recorded for every month of the year.

***Affinities*:** *Camptacra robusta* appears closest to *C. barbata*, but differs by the capitula 8–12 mm long and 13–21 mm across (5–8 mm long and 8–14 mm across for *C. barbata*), the leaves 4.5–12 mm wide (1.4–5 mm wide for *C. barbata*), the peduncles 0.8–1.5 mm wide at midpoint (0.4–0.8 mm wide for *C. barbata*), and the inner involucral bracts 6–7.5 mm long (3.5–5.5 mm long for *C. barbata*).

***Notes*:** *Camptacra* specimens from Papua New Guinea are here tentatively included under *C. robusta*, based on the relatively long disc florets and ligules on the most mature specimen (*Robbins 916*). However, in the few Papuan specimens available, there is much variation in leaf size, capitulum size and pappus length. More collections are needed before a reliable taxonomic assessment can be made.

Some Queensland specimens of *Camptacra robusta* have been misidentified as *Olearia arguta* Benth. The first such instance was by Britten (1901), who identified a Banks & Solander collection from Endeavour River as *Shawia arguta* (Benth.) Britten, a synonym of *O. arguta*. Another specimen (*Rodd & Hardie 4461*, cited above) was identified by N. Lander in 1990 as *O. arguta*, and subsequently, numerous specimens at BRI were named *O. arguta* or *O. arguta* var. *lanata* Benth. Molecular studies have confirmed that the Queensland taxon is correctly placed in *Camptacra* (see Introduction). Some specimens of this species have very dense woolly indumentum on the leaves and stems.

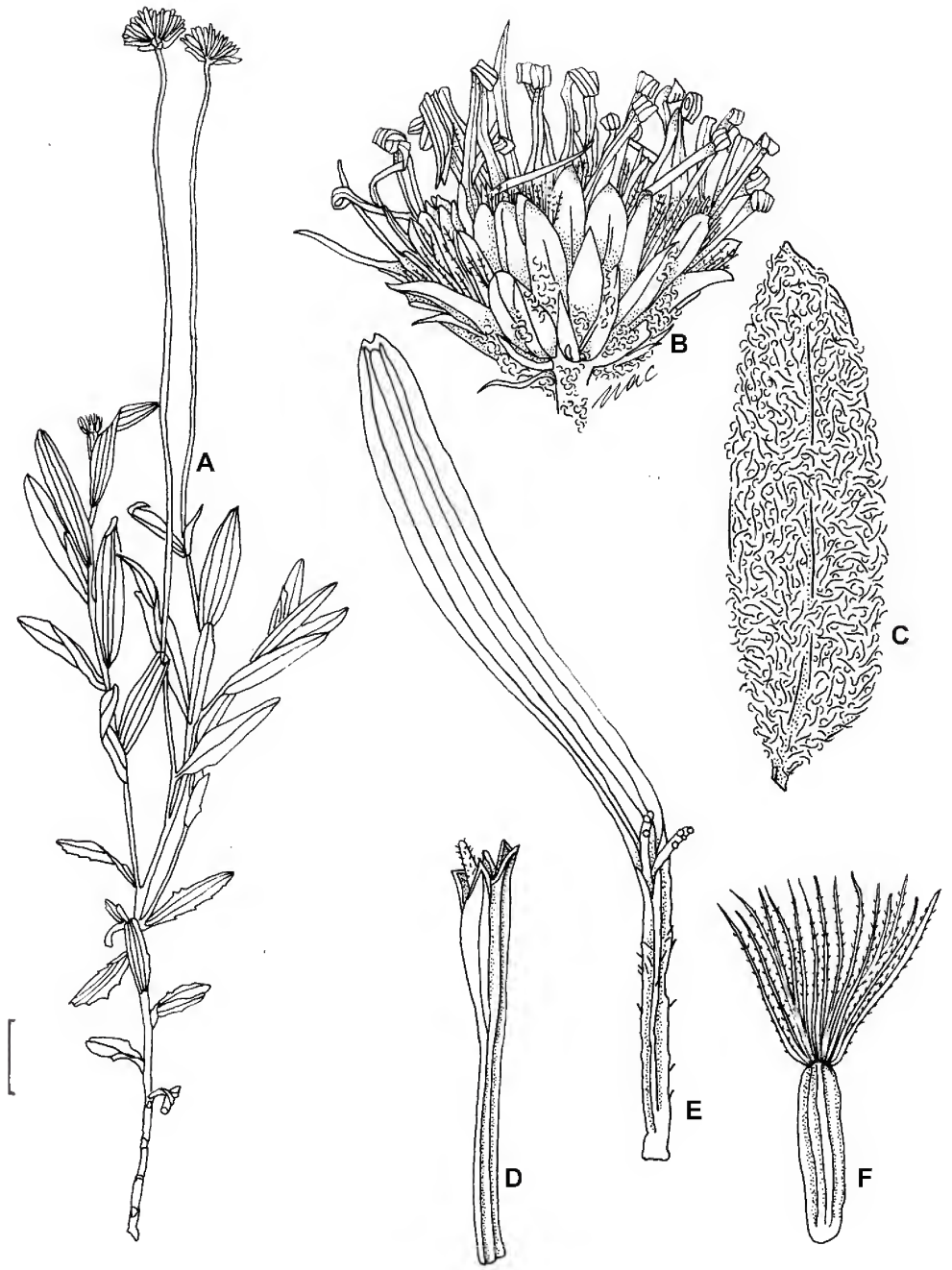

Fig. 2. ***Camptacra robusta***. A. flowering branchlet ×0.5. B. flowering capitulum, lateral view ×4. C. a leaf from the densely hairy form ×4. D. disc floret ×12. E. ligulate floret ×12. F. mature achene with pappus ×6. A from *McDonald KRM3234* (BRI); B,C,E from *Jensen 2539* (BRI); D from *Forster PIF9512* (BRI); F from *Thompson BUC2084* (BRI). Scale bar = 10 mm at ×1 magnification. Del. N. Crosswell.

***Conservation status*: Least Concern** (IUCN 2012). The habitat of this species has been reduced over the last century; however, it is a common species with a large geographical range, and is present in at least ten National Parks.

***Etymology*:** From the Latin *robustus*, meaning solid or strong; this refers to the sturdy and vigorous appearance of the species in comparison with other species of *Camptacra*.

Acknowledgements

I thank the Directors of DNA, CANB and MEL for sending their holdings of *Camptacra* on loan. I am also grateful to Will Smith for the illustrations of *C. perdita* and Nicole Crosswell for the illustrations of *C. robusta*. Peter Jobson made numerous helpful suggestions. I thank Teghan Collingwood for her efforts to locate the New South Wales specimen of *C. perdita* at BRI.

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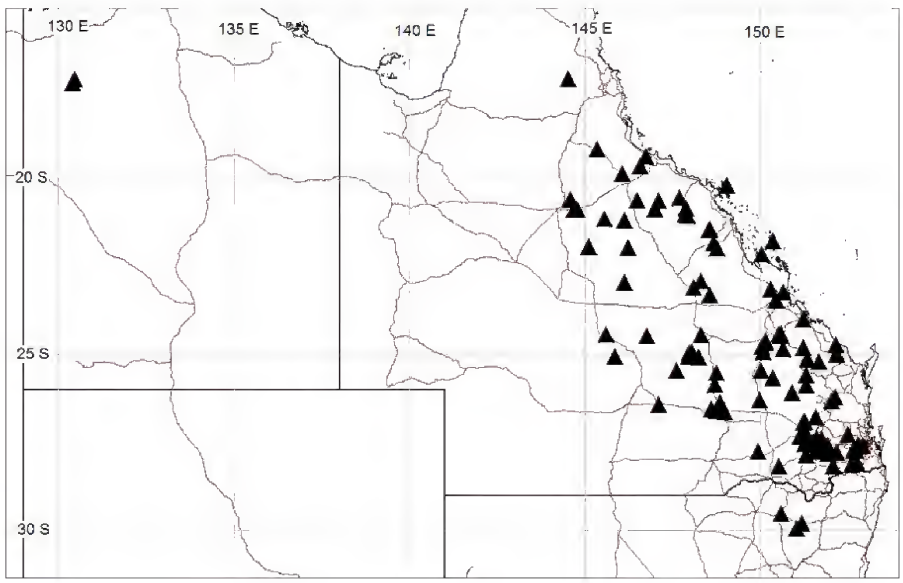
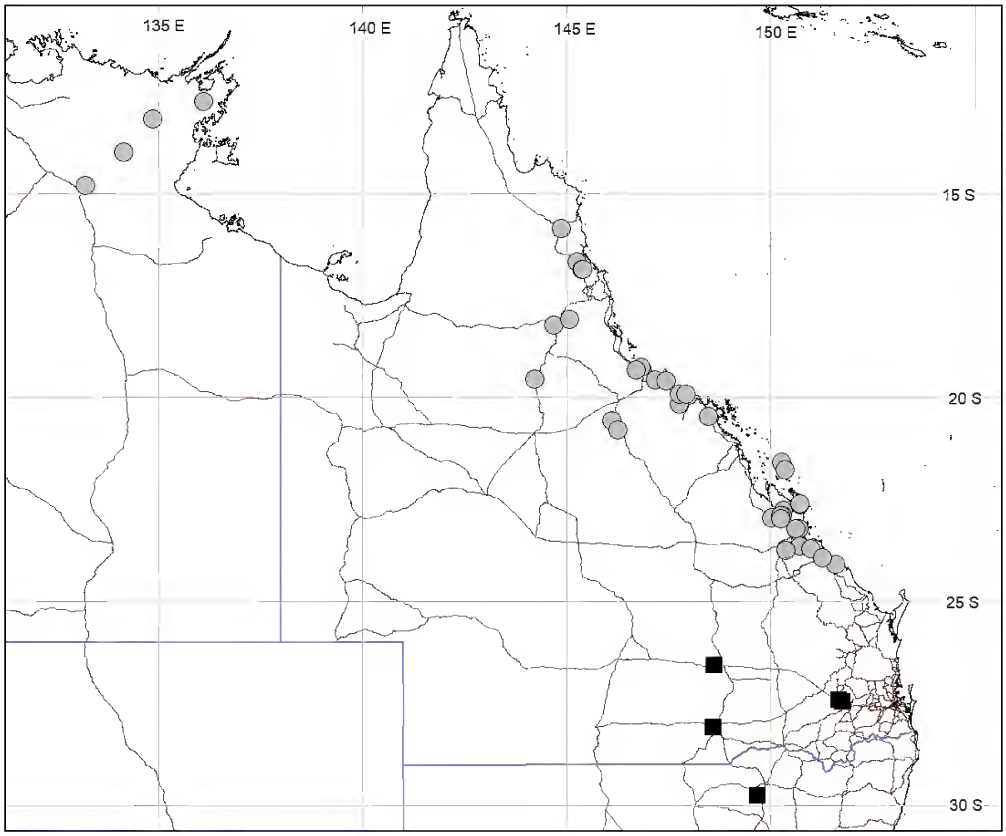
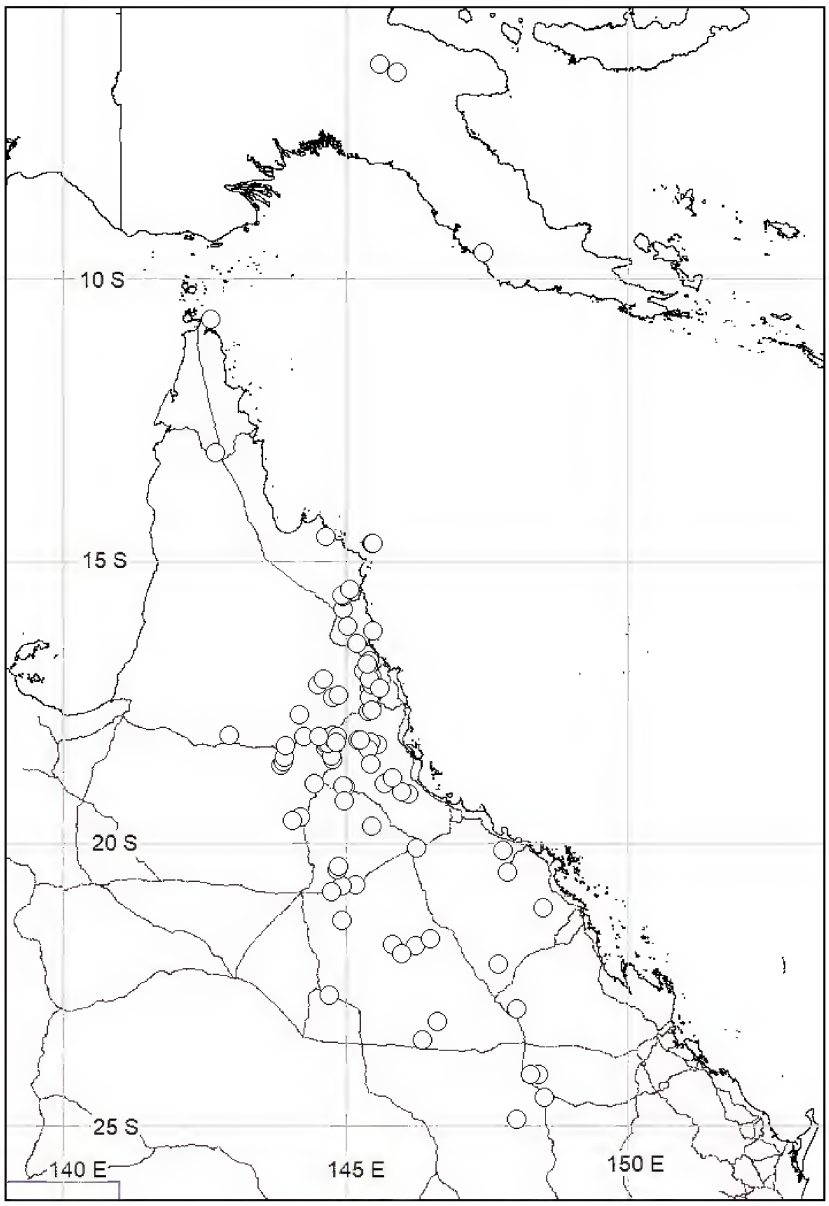


Map 1. Distribution of ***Camptacra barbata***.



Map 2. Distribution of ***Camptacra gracilis*** ● and ***C. perdita*** ■.



Map 3. Distribution of ***Camptacra robusta***.

A taxonomic revision of the genus *Lagenophora* Cass. (Asteraceae: *Astereae*) in New Guinea

Jian Wang & A.R. Bean

Summary

Wang, J. & Bean, A.R. (2020). A taxonomic revision of the genus *Lagenophora* Cass. (Asteraceae: *Astereae*) in New Guinea. ***Austrobaileya* 10(4): 576–582**. The genus *Lagenophora* Cass. is taxonomically revised for New Guinea with two species recognised. One (*Lagenophora sporadica* Jian Wang ter & A.R.Bean sp. nov.) is endemic to New Guinea and the other (*L. sublyrata* (Cass.) A.R.Bean & Jian Wang ter) is widespread in Asia, Australia and Malesia. The species are described and illustrated. Notes are provided on the distribution (including a map), habitat and phenology. An identification key is provided.

Key Words: Asteraceae; *Astereae*; *Lagenophora sporadica*; *Lagenophora sublyrata*; New Guinea flora; new species; identification key; distribution map

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Introduction

Lagenophora Cass. is a small genus of daisies in the Tribe *Astereae* and found mainly in the temperate parts of the southern hemisphere. Twelve species are found in Australia (Wang & Bean 2019), nine species occur in New Zealand (Breitwieser *et al.* 2012), three species in southern South America (Cabrera 1966) and two in New Guinea. The genus also extends to New Caledonia and Indonesia, and as far as Sri Lanka and southern Japan (Koidzumi 1928; Wang & Bean 2019).

The genus *Lagenophora* was first recorded for New Guinea by Mueller (1889), based on a specimen collected by William MacGregor from the summit of the Owen Stanley Range, earlier that same year. Cabrera (1966) cited New Guinea specimens for three species, *L. gracilis* Steetz, *L. lanata* A.Cunn. and *L. stipitata* (Labill.) Druce. Koster (1966) reduced this to two species, *L. stipitata* and *L. lanata*, and stated that *L. gracilis* and *L. lanata* could not be maintained as separate species, as the former differs only by the sparser tomentum.

The present authors concur with Koster (1966) that two species are present – one is *L. sublyrata* (Cass.) A.R.Bean & Jian Wang ter, of which *L. lanata* is a synonym and the other is *L. sporadica* Jian Wang ter & A.R.Bean, a new species closely related to *L. stipitata*.

Materials and methods

This revision is based on morphological examination of *Lagenophora* material from the following herbaria: A, AK, BRI, CANB, GH, HO, L, MEL and NSW. Images of type specimens held at FI, G, HAL, K, M, NY, P and W have also been examined and are indicated as *i.d.v.* (*imago digitalis visa*). Most measurements are based on dried material, but the dimensions of florets are based on material reconstituted with boiling water. Dimensions in the descriptions are inclusive, *viz.* 1.0–1.7 is given as 1–1.7.

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Taxonomy

Key to the New Guinea species of *Lagenophora*

Roots tuberous and fleshy, bunched; rhizomes short; stem very short (leaves in basal rosette); scape hairs appressed to antrorse; achene glands confined to the dorsal side of beak and adjacent upper dorsal edge; achenes usually with 1–3 hairs at base; achene 2.2–2.4 mm long excluding beak . . . . . **L. sublyrata**

Roots fibrous and wiry, not bunched, rhizomes spreading; stem usually elongated (leaves alternate along stem), scape hirsute, hairs retrorse to patent; achene papillae extending all along ventral and dorsal edges from beak to carpopodium, and on the basal and distal portions of both faces; achenes without basal hairs; achene 2.9–3.4 mm long excluding beak . . . . . **L. sporadica**

1. Lagenophora sublyrata (Cass.) A.R.Bean & Jian Wang ter, *Austrobaileya* 10: 435–437 (2019); *Ixauchenus sublyratus* Cass., *Dict. Sci. Nat. ed. 2. [F. Cuvier]* 56: 176 (1828). **Type:** Australia. [New South Wales.] Port Jackson, November–December 1819, *C. Gaudichaud s.n.* (lecto: image of P 00742955† *i.d.v.*), *fide* Bean & Wang (2017: 168). **Epitype:** New South Wales. Hornsby, April 1914, *W.F. Blakely s.n.* (NSW 10275), *fide* Bean & Wang (2017: 168).

Ixauchenus lyratus Less., *Syn. Gen. Compos.* 193 (1832), *nomen nudum*.

Lagenophora billardierei var. *media* DC., *Prodr. [A. P. de Candolle]* 5: 307 (1836). **Type:** Nova Hollandia, [in 1823], *F.W. Sieber 505* (syn: G 00454010 *i.d.v.*; HAL *i.d.v.*; NY 00180436 *i.d.v.*).

Lagenophora billardierei var. *glabrata* DC., *Prodr. [A. P. de Candolle]* 5: 307 (1836). **Type:** Nouvelle Holland, in 1816, from Lambert's herbarium (syn: G 00454009 *i.d.v.*).

Lagenophora lanata A.Cunn., *Ann. Nat. Hist.* 2: 126 (1839). **Type:** New Zealand. Between the Waitangy and Keri-Keri Rivers, in 1834, *R. Cunningham s.n.* (lecto: K 000890104 *i.d.v.*), *fide* Allen (1961: 606).

Perennial rhizomatous herb; roots fleshy, bunched, 0.2–1 mm diameter; no stem or short stem to 10 mm long; leaves and scapes firmly attached to stem and/or rootstock. Leaves 4–9(–11), obovate, oblanceolate, elliptical, spathulate, 1–2 cm long by 0.4–0.8 cm wide (*c.* 2.5 × longer than wide), sessile or with a winged petiole-like base to 1 cm long; leaf apex obtuse or rounded; leaf margins toothed, crenate to sinuate, with 5–7(–9) teeth, each tooth 0.2–0.4 mm long; upper leaf surface green, with 2–7 hairs per mm^2, each 0.1–0.3 mm long; lower leaf surface pale green, with 3–7 hairs per mm^2, each 0.1–0.4 mm long; leaf margins with 6–12 hairs per mm^2, each 0.1–0.3 mm long; net veins usually obscure on dried material on both surfaces. Scapes channelled, 1–6 per tuft, each (2.5–)4–8 cm long at anthesis, 4–11 cm long at fruiting stage, 0.3–0.4 mm diameter, 0.3–0.5 mm thick from lowest to upmost section; scape bracts 2–4, upper ones *c.* 0.6 × 0.2 mm, lower ones *c.* 1.4 × 0.4 mm; scape indumentum *c.* 0.1 mm long, antrorse, more or less appressed; 2–6 hairs per mm at midpoint of scape, slightly denser towards apex. Capitula 2.5–3.5 mm long, 2.5–5 mm diameter; involucral bracts (20–)25 in 3 or 4 rows, lanceolate, oblong to obovate, apex obtuse, acute, ciliate or with fringed margin on distal part, glabrous, outer bracts 1.2–1.5 × 0.3–0.4 mm, inner bracts 2.2–2.8 × 0.5–0.6 mm. Receptacle convex, 0.6–0.8 mm diameter and 0.5–0.8 mm high. Ray florets 20–30 in 2–4 rows; tube *c.* 0.4 mm long, 0.1–0.2 mm wide, glandular hairy; style branches *c.* 0.4 mm long; ligules 1.8–2 mm long, 0.15–0.35 mm wide, with longitudinal veins obscure, creamy, yellow or purple, apex obtuse. Disc florets 10–15, corolla tubular, 1.5–1.8 mm long, light yellow, outer surface with sparse glandular hairs; corolla lobes 5, deltate, 0.2–0.3 mm long × 0.3–0.35 mm

wide; stamens 5, anthers *c.* 0.6 mm long; style branches *c.* 0.2 mm long; sterile ovary 0.6–0.7 mm long; pappus scales 1 or 2, *c.* 0.1 mm long. Achenes compressed, lanceolate, obliquely oblanceolate, 2.2–2.4 × 0.4–0.6 mm excluding beak, light brown to dark brown at maturity; achene edges more or less thickened; with 1–3 eglandular hairs present usually at base of achene; achene glands confined to dorsal side of beak and adjacent area of achene; achene beak 0.4–0.5 mm long, with a thickened white annular collar at its apex, 0.15–0.2 mm diameter. **Fig. 1**.

***Additional specimens examined*: Indonesia. Papua.** Balim River, Dec 1938, *Brass 11782* (BRI, CANB, L); near Lake Gita, Angi, Arfak Mts, Apr 1940, *Kanehira 14115 & Hatusima* (L); Anggi Gita Lake, Bivouac Noordpool, Jan 1962, *Sleumer 14020 & Vink* (BRI, CANB, L). **Papua New Guinea.** Western Highlands Province: Yobobos grassland area, Laiagam subdistrict, Aug 1960, *Hoogland 7505 & Schodde* (CANB, L). Southern Highlands Province: Between Kendatel and Yombi, *c.* 6 miles [10 km] N of Ialibu patrol post, Jul 1961, *Pullen 2735* (CANB). Morobe Province: Mannasat, Cromwell Mountains, Huon Peninsula, Jul 1964, *Hoogland 9450* (CANB); *ibid*, Aug 1964, *Hoogland 9614* (BRI, L); Watama, Menyamya subdistrict, May 1968, *Streimann NGF35897 & Kairo* (L). Central Province: Boridi, Nov 1935, *Carr 13441* (CANB, L); Mafulu, Sep 1933, *Brass 5151* (BRI, L); Coastal scarp of Astrolabe Range, SW of Birribi, Aug 1970, *Schodde 5637* (L); Coast scarp of Astrolabe Range, Port Moresby subdistrict, Aug 1970, *Stevens LAE50342* (BRI, CANB, L). Milne Bay Province: Maneau Peak, Mt Dayman, May 1953, *Brass 22255* (CANB, L); E slopes, Goodenough Island, Oct 1953, *Brass 24666* (CANB, L); Mt Wadimana ridge, NE from Mt Simpson, Jul 1969, *Pullen 7865* (CANB); Summit area of Mt Wadimana, eastern Mt Simpson Range, Jul 1969, *Schodde 5480* (CANB); Mt Suckling Complex, Mayu II, Raba Raba Subdistrict, Jun 1972, *Stevens LAE54980 & Veldkamp* (BRI, L); Goropu Mountains (Mt Suckling), Jun 1972, *Veldkamp 5536 & Stevens* (L).

***Distribution and habitat*:** *Lagenophora sublyrata* is the most widespread species in the genus. It has been called by the misapplied name *L. gracilis* or the synonymous name *L. lanata* in south Asia (e.g. India, Sri Lanka), south-east Asia (e.g. Vietnam), China, Malesia (e.g. Java), New Caledonia, Australia and New Zealand. In New Guinea, it has a widespread distribution (**Map 1**). It mainly inhabits montane grassland near rainforest margins on sandy or fine gravel deposits in wet situations from 670 m to 2750 m above sea level. It has also been recorded on dry sandy or rocky flats.

***Phenology*:** Flowers and fruits have been recorded throughout the year except February and March.

***Note*:** *Lagenophora sublyrata* is a widespread species with variable leaf shape, indumentum and plant size. New Guinea specimens are usually quite hairy and small in stature, as are specimens from New Zealand, but features of the roots, the achene, scape and involucral bracts are consistent with typical plants from eastern Australia.

2. Lagenophora sporadica Jian Wang ter & A.R.Bean, **sp. nov.** with affinities to *L. stipitata* (Labill.) Druce and *L. adenosa* Jian Wang ter & A.R.Bean, but differing from *L. stipitata* by the sinuate to undulate leaf margins, the two types of scape indumentum, the shorter ligules of the ray florets, and differing gland and/or papillae distribution on the achene surfaces. It differs from *L. adenosa* by the smaller sized ligules, and the gland distributional pattern on achene surfaces. **Typus:** Papua New Guinea. Oro (Northern) Province: Mt Kenive (Nisbet), Kokoda Subdistrict, 30 July 1974, *J.R. Croft et al. LAE65116* (holo: BRI [AQ352188]; iso: A [2 sheets], CANB 559390, L 1815314).

[*Lagenophora stipitata, auct. non* (Labill). Druce; Koster (1966: 590)].

Perennial rhizomatous herb; roots and rhizomes fibrous; stem usually elongated (leaves alternate along stem) or occasionally short (leaves in near basal rosette); leaves and scapes firmly attached to stem and/or rootstock. Leaves 5–10, obovate to long-spathulate, 1.5–4 cm long by 1–2.2 cm wide (1.5–1.8× longer than wide), with a winged petiole-like base 1–4 cm long; leaf apex obtuse; leaf margins sinuate to undulate, usually with 9–11(–17) shallow lobes, each lobe 0.5–2 mm long; upper leaf surface grey green; with eglandular hairs 0.3–0.6 mm long, 4–10 per mm^2; lower leaf surface pale green; with eglandular hairs 0.2–0.6 mm long, 1–6 per mm^2; both leaf surfaces have papillae to 0.01 mm long, more or less evenly distributed; leaf margins with 6–14 eglandular hairs per mm^2, each 0.4–0.8 mm

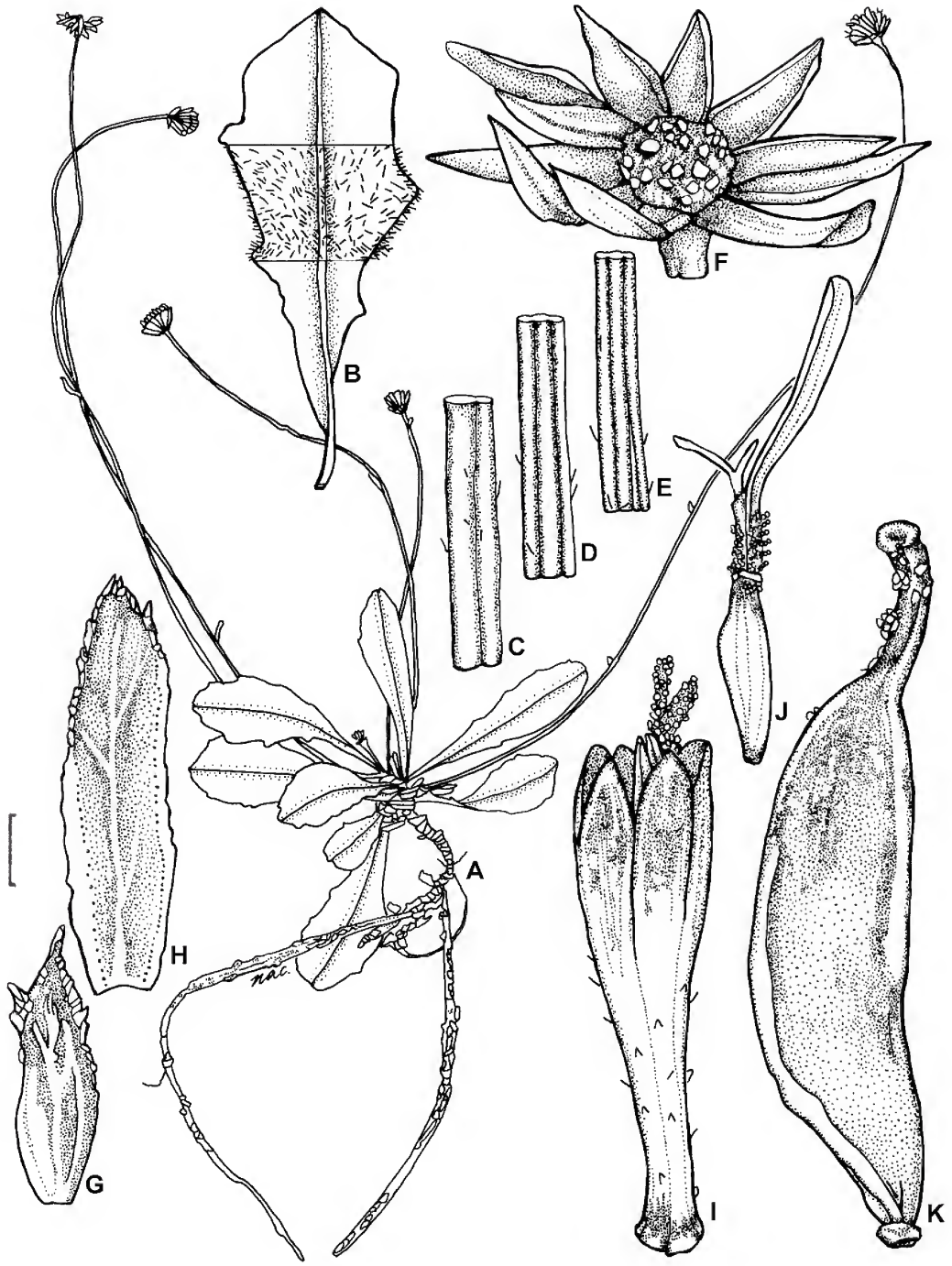

Fig. 1. ***Lagenophora sublyrata.*** A. habit of whole plant with flowering inflorescences ×1.5. B. leaf with a section in details ×5. C–E. lower, mid and upper-sections of scape ×20. F. capitulum with flowers and fruits removed, lateral view ×20. G. outer involucral bract ×20. H. inner involucral bract ×20. I. disc floret ×35. J. marginal floret ×35. K. achene ×35. A from *Stevens LAE50342* (BRI), B, F from *Brass 5151* (BRI), C–E from *Stevens & Veldkamp LAE54980* (BRI), G–J from *Hoogland 9614* (BRI), K from *Brass 11782* (BRI). Scale bar = 10 mm at ×1 magnification. Del. N. Crosswell.

long; lateral veins obscure on upper leaf surfaces, but obvious on lower leaf surfaces. Scapes channelled, 1–3(–4) per tuft, each 2–7 cm long at anthesis, 6–14 cm long at fruiting stage, *c.* 0.6 mm diameter but expanding to *c.* 1.4 mm at apex; scape bracts 2–3, upper ones *c.* 4 × 0.5 mm, lower ones *c.* 8 × 1.8 mm; scape indumentum including eglandular hairs 0.2–0.5 mm long, appressed, patent or retrorse; 1–4 hairs per mm^2 at midpoint of scape, 4–8 hairs per mm^2 towards apex; and papillate to *c.* 0.01 mm long, 5–15 per mm^2 at midpoint of scape, but very densely distributed towards apex. Capitula 4–5(–6) mm long, 7–12 mm diameter; involucral bracts *c.* 54 in 3 or 4 rows, linear, lanceolate, apex acute to acuminate, with fringed margins on distal half, papillate with eglandular hairs occasionally along midrib on outer surface; outer bracts *c.* 2.5 × 0.5 mm, inner bracts 2.5–3.5 × 0.3–0.7 mm. Receptacle convex to hemispherical, 2.8–4.4 mm diameter and 1.4–2.5 mm high. Ray florets *c.* 83, in 3–4 rows; tube 0.5–0.9 mm long, *c.* 0.3 mm wide, with papillae; style branches *c.* 0.6 mm long; ligules 1.9–2.2 × 0.3–0.4 mm, longitudinal veins obscure, white or pink, apex obtuse and bidentate. Disc florets *c.* 11; corolla tubular, *c* 1.8 mm long, greenish or yellow, outer surface covered with papillae; corolla lobes (4–)5, deltate, 0.3–0.4 × *c.* 0.3 mm; stamens (4–)5, filaments 1.1–1.5 mm long, anthers 0.6–0.8 mm long; style branches 0.4–0.7 mm long; sterile ovary 2.2–2.5 mm long, with a thickened white annular collar at its apex, collar *c.* 0.3 mm diameter. Achenes compressed, oblanceolate, straight or slightly curved, 2.9–3.4 mm long excluding beak, *c.* 1 mm wide, uniformly brown at maturity; achene edges slightly thickened; achene papillae extending all along ventral and dorsal edges from beak to carpopodium, and on the basal and distal portions of both faces; achene beak 0.5–1.1 mm long, densely surrounded by papillae, and with a white annular collar at its apex, 0.2–0.25 mm diameter. **Fig. 2**.

***Additional selected specimens examined*: Papua New Guinea.** Eastern Highlands Province: Mt Aniata, Mar 1959, *Cruttwell 1057* (K, L); Mt Wilhelm, Nov 1960, *Borgmann 315* (L). Central Province: Mt Albert Edward, May/Jul 1933, *Brass 4226* (A, BRI, K, L); NW part of Mt Albert Edward, Jun 1974, *Craven 2750* (A, CANB, K, L). Morobe Province: Samanzing vicinity, Upper Camp, Feb 1939, *Clemens 9585* (L 1815313, L 1815327); *ibid*, Feb 1939, *Clemens 9910A* (A, L); Mt Enggom, Sarawaket Range, Feb 1963, *van Royen NGF16204* (BRI, CANB, L). Oro (Northern) Province: W slopes Mt Kenive (Nisbet), Kokoda Subdistrict, Aug 1974, *Croft LAE65155* (BRI, L). Milne Bay Province: Mt Ganaina, Aug 1962, *Cruttwell 1280* (K, L); Goropu Mountains (Mt Suckling), Jun 1972, *Veldkamp & Stevens 5678* (CANB, L); S Spur of Goe Dendeniwa, Mt Suckling complex, Jun 1972, *Stevens & Veldkamp LAE54205* (A, BRI, CANB, K, L); Slopes of Goe Dendeniwa, Mt Suckling complex, Raba Raba Subdistrict, Jun 1972, *Stevens & Veldkamp LAE54279* (A, BRI, CANB, K, L); E slope of Manurep, Raba Raba Subdistrict, Jul 1972, *Stevens & Veldkamp LAE54497* (A, BRI, CANB, K, L).

***Distribution and habitat*:** *Lagenophora sporadica* is endemic to Papua New Guinea where it is restricted to high altitudes from 2400 to 3800 m (**Map 1**). It grows in conifer dominated submontane rainforest and relictual forest that can be dominated by *Prunus*, *Podocarpus* or *Papuacedrus*. It is also recorded from the shade of subalpine shrubberies; subalpine grasslands in rocky places with low grass; and in the shelter of forest borders and logs. It can be a common species even in burnt forest areas.

***Phenology*:** Both flowers and fruits were recorded in February, March, May to August, and November.

***Typification*:** It is indicated on the label of the type specimen of *Lagenophora sporadica* that duplicates of *LAE65116* are also present at BISH, BM, BO, E, K, LAE, M, PNH, SING, SYD and US, but none of these have been seen by the present authors.

***Affinities*:** *Lagenophora sporadica* is of similar appearance to *L. stipitata*, but differs by the sinuate to undulate leaf margins (obtusely serrate for *L. stipitata*), the two types of scape indumentum (usually one type only for *L. stipitata*), the ligules of the ray florets 1.9–2.2 mm long, (2.3–3.3 mm long for *L. stipitata*), and different gland and/or papillae distributional patterns on the achene surfaces. It also resembles *L. adenosa,* but differs from that species by the smaller sized ligules at 1.9–2.2 × 0.3–0.4 mm (3–3.4 × 0.4–0.6 mm for *L. adenosa*), and the distributional patterns of glands and/or papillae on achene surfaces.

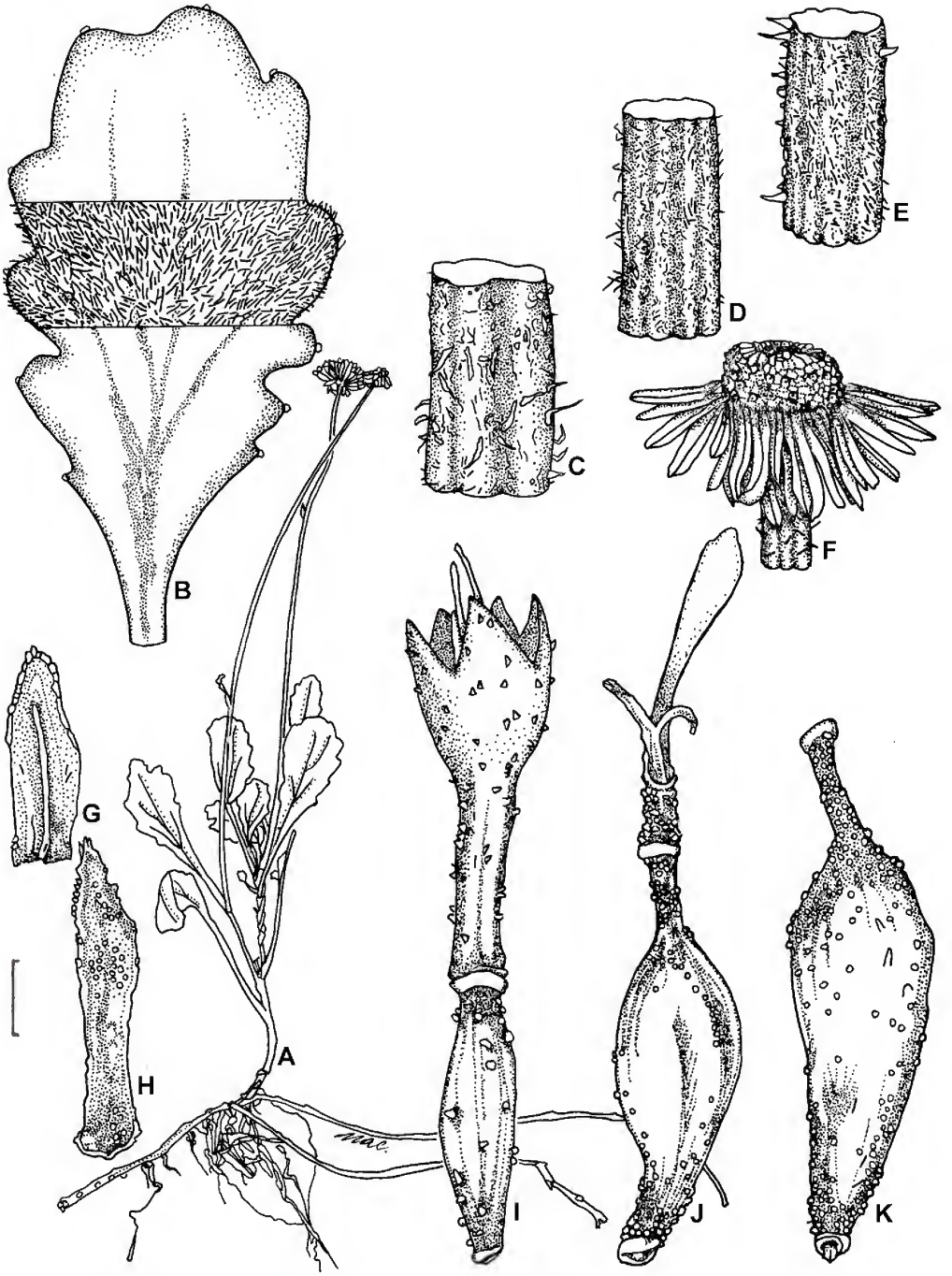

Fig. 2. ***Lagenophora sporadica.*** A. habit of whole plant with flowering inflorescences ×0.5. B. leaf with a section in details ×5. C–E. lower, mid and upper-sections of scape ×15. F. capitulum with flowers and fruits removed, lateral view ×5. G. outer involucral bract ×15. H. inner involucral bract ×15. I. disc floret with immature achene ×20. J. marginal floret with near mature achene ×20. K. achene ×20. A, C–K from *Croft LAE65116* (BRI), B from *Craven 2750* (CANB). Scale bar = 10 mm at ×1 magnification. Del. N. Crosswell.

***Etymology*:** From the Latin *sporadicus*, meaning 'scattered' or 'widely dispersed'. This refers to the widely dispersed glands and/or papillae on the faces of the achenes, in comparison with *Lagenophora adenosa* and *L. stipitata*.

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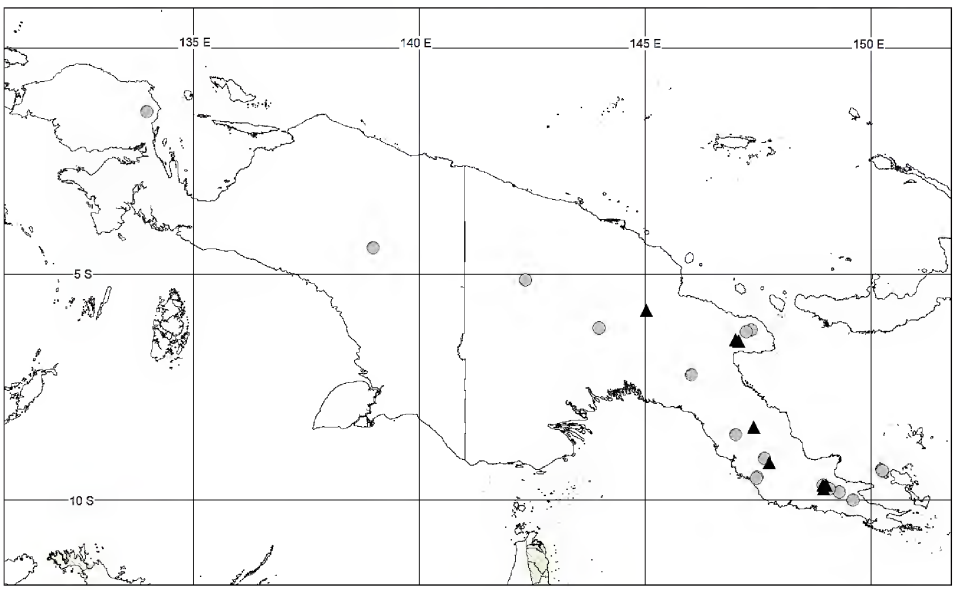

Map 1. Distribution of ***Lagenophora sublyrata*** ● and ***L. sporadica*** ▲ in New Guinea.

Lobelia fenshamii N.G.Walsh & Albr. and *L. fontana* Albr. & N.G.Walsh (Campanulaceae: *Lobelioideae*), two new species endemic to artesian springs in central and south-western Queensland

David E. Albrecht[1], Neville G. Walsh[2], Richard W. Jobson[3] & Eric B. Knox[4]

Summary

Albrecht, D.E., Walsh, N.G., Jobson, R.W. & Knox, E.B. (2020). *Lobelia fenshamii* N.G.Walsh & Albr. and *L. fontana* Albr. & N.G.Walsh (Campanulaceae: *Lobelioideae*), two new species endemic to artesian springs in central and south-western Queensland. ***Austrobaileya* 10(4): 583–593**. *Lobelia fenshamii* and *L. fontana*, endemic to artesian springs in central and south-western Queensland, are described and illustrated, with notes on distribution, habitat, conservation status and features distinguishing them from closely related species of *Lobelia* and *Isotoma*.

Key Words: Campanulaceae; *Lobelioideae*; *Lobelia*; *Isotoma*; *Lobelia fenshamii*; *Lobelia fontana*; *Isotoma fluviatilis*; Australia flora; Queensland flora; new species; taxonomy; conservation status; artesian springs

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Introduction

Although *Isotoma* (R.Br.) Lindl. is currently recognised as distinct from *Lobelia* L. in Australia (CHAH 2020), recent molecular data (Knox *et al.* 2006; Antonelli 2008; Knox & Li 2017; E.B. Knox unpubl. data) place *Isotoma* species and many southern hemisphere *Lobelia* species in a predominantly Australasian clade that originated in Australia. Lammers (2011) assigned species in this clade to *Lobelia* section *Hypsela* (C.Presl) Lammers although he did not provide combinations for those species of *Isotoma* lacking available names in *Lobelia*. Further sampling and analyses are underway to improve the phylogenetic resolution and resolve generic limits prior to making nomenclatural changes. In the absence of a final resolution on the status of *Isotoma*, Heenan *et al.* (2008) described three new species from New Zealand in *Lobelia* despite them all having an entire or weakly cleft corolla tube, a feature traditionally regarded a characteristic of *Isotoma*. Albrecht *et al.* (2018) adopted a similar approach when describing *Lobelia claviflora* Albr. & R.W.Jobson, a species with a weakly cleft corolla tube. For consistency the two new species described herein are named as species of *Lobelia* rather than *Isotoma*, while acknowledging that the generic limits of *Lobelia* and status of *Isotoma* are still not fully resolved.

The two new species are artesian spring endemics and have highly restricted distributions. The ecology of springs of the Great Artesian Basin has received considerable study in recent years, with numerous endemic species of flora and invertebrate fauna identified (e.g. Commonwealth of Australia 2014; Fensham *et al.* 2016b). The number and quality of intact springs has been dramatically reduced since European settlement because of groundwater extraction, and it is believed that the extinction of endemic plants and animals

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has occurred (Rossini *et al.* 2018). While the capping of bores that have historically depleted the aquifer has partly been completed, the security of remaining functional springs remains threatened by continuing damage by stock, feral animals (e.g. pigs) and, potentially, mining and coal-seam gas extraction (Fensham *et al.* 2010). These artesian spring-fed ecosystems are listed as Endangered under the Australian *Environment Protection and Biodiversity Conservation Act 1999* (EPBC) with any proposed developments requiring referral (Doody *et al.* 2019). Consequently, there is a conservation imperative for as-yet undescribed species to be elucidated to assist future actions that may serve to secure or enhance remaining springs.

Materials and methods

The descriptions are based on fresh, field-collected plants, herbarium specimens and transplants grown in cultivation at the Alice Springs Desert Park (ASDP) nursery, Australian National Botanic Gardens (ANBG) nursery, and a private garden in Sydney. Floral measurements were taken from fresh, spirit or rehydrated material. Hypanthium features were assessed at flowering stage unless otherwise stated. Corolla tube length was measured from the corolla base (where it becomes distinct from the hypanthium) to the sinuses between the three lobes of the lower lip, thus including the proximal part of the lower lip where the three lobes are fused. The length of the upper two corolla lobes was measured as the distance between the tip of the lobe and sinus between the upper (2-lobed) and lower (3-lobed) lips. The length of the lateral lobes of the lower lip was measured as the distance between tip of the lobe and sinus between the lateral and central lobe of the lower lip. The length of staminal filaments was measured as the distance between the points where they join the anther tube and hypanthium. All dimensions are inclusive, *viz.* 1.0–1.7 is given as 1–1.7.

Taxonomy

1. Lobelia fenshamii N.G.Walsh & Albr. **sp. nov.** with affinity to *Isotoma fluviatilis* (R.Br.) F.Muell. ex Benth., differing in its smaller, slightly more actinomorphic corollas that lack both contrasting yellow–green patches in the throat and a contrasting darker transverse colour band towards the base of the lower 3 lobes, shorter calyx lobes, almost entirely connate staminal filaments that are wholly free of the corolla and indehiscent fruits. Also with affinity to *Lobelia fontana*, but differing in its smaller corollas, shorter hypanthium, shorter calyx lobes, shorter anther tube, absence of bracteoles, shorter and differently shaped fruits that tend to be downturned into the soil, and seeds with a vermiculate surface pattern. It superficially resembles *Lobelia irrigua* R.Br. but that species has unisexual flowers, a deeply cleft corolla tube, shortly connate staminal filaments, longer fruits and seeds with a reticulate-alveolate surface pattern. **Typus:** Queensland. Mitchell District: Myross, E of Aramac, 15 May 2000, *R.J. Fensham 3883* (holo: BRI).

Isotoma sp. (Myross R.J. Fensham 3883); Forster (2007: 41, 2010: 36, 2018, 2020); CHAH (2020).

Herbaceous semi-aquatic rhizomatous perennial *forb*, completely prostrate and loosely mat-forming or ascending slightly (to *c.* 4 cm high), rooting at the nodes. *Stems* terete, zig-zagged, glabrous, often spongy or hollow. *Leaves* distichous, alternate, sessile or with a petiole-like base to *c.* 2.5 mm long; lamina narrowly to broadly elliptic, ovate or obovate (often markedly different leaf shapes occurring synchronously on the same plant), flat or convex, rather thick-textured and rigid, 1.5–6(–10) mm long, 0.6–2(–6) mm wide, l:w ratio 1.4–3:1, pale green to yellowish green, glabrous, with 1-few minute embedded marginal glands on each side, margin entire or minutely indented corresponding with position of a gland, apex obtuse to rounded, usually with a minute embedded apical gland, base attenuate or rather abruptly tapered to a petiole-like base. *Flowers* bisexual, solitary in axils. *Bracteoles* absent. *Pedicels* 2–8 mm long (3–10 mm in fruit), not or barely exceeding subtending leaf in flower, up to *c.* twice as long as leaf in fruit, glabrous, widely spreading or reflexed when fruiting, tending to bury the fruit into the substrate. *Hypanthium*

obconical to obovoid or ellipsoid, 1.5–2.1 mm long, 1–1.4 mm wide, glabrous. *Calyx lobes* erect in flower and fruit, triangular, 0.3–0.6 mm long and wide, glabrous, entire. *Corolla* almost actinomorphic, rotate to campanulate, very weakly 2-lipped, 1.5–2.8 mm long, wholly and evenly white to pale cream or rarely with pinkish veins on abaxial side of lobes; corolla lobes linear-lanceolate to triangular, 1.3–1.6 mm long, 0.6–0.8(–1.1) mm wide, spreading with slightly recurved acute tips, glabrous; tube 0.5–1.3 mm long, expanding slightly from base, *c.* 1.5 mm diam. at throat, slightly to distinctly longer than calyx lobes, not or weakly cleft on dorsal side to within 0.5–1 mm of base, glabrous or with a few spreading hairs internally towards base. *Staminal filaments* 0.7–1(–1.2) mm long, connate for all but up to 0.2 mm at base, attached at apex of hypanthium, entirely free from the corolla tube, glabrous. *Anther tube* more than half to almost fully exserted beyond dorsal corolla tube sinus, 0.7–1 mm long, greyish-blue or purplish, glabrous except around the apical orifice, two ventral anthers each with an apical seta 0.2–0.3 mm long and an associated tuft of finer hairs 0.1–0.2 mm long, dorsal anthers glabrous apically. *Style* glabrous; stigmatic lobes 2, elongate-hemispherical. *Fruit* obovoid to broadly ellipsoid or globose, slightly compressed laterally, 2–3 mm long, 1.4–2.7 mm wide, glabrous, inconspicuously veined; apical portion raised 0.5–0.7 mm above the rim of the hypanthium, apparently indehiscent and releasing seeds through rupture or rotting of the thin walls; persistent calyx lobes erect, not accrescent. *Seeds c.* 20 per capsule, ellipsoid to broadly ellipsoid, slightly compressed, 0.5–0.7 mm long, (0.25–)0.3–0.45 mm wide, pale to mid-brown; testa with a network of wavy ridges (vermiculate). **Figs. 1 & 2**.

***Additional specimens examined*: Queensland.** South Kennedy District: 'Doongmabulla' NW of Clermont, Feb 1999, *Fensham 3336* (BRI). Mitchell District: Edgbaston, E of Aramac, Feb 1998, *Fensham 3334* (BRI); Edgbaston, Aramac, Mar 1995, *Chuk E10 & Wylks* (BRI); First Spring, Edgbaston Reserve, E of Aramac, Apr 2012, *Bean 31636* (BRI). Warrego District: Yowah Creek Springs, Bundoona, Feb 2005, *Fensham 5233* (BRI); *ibid*, Dec 2012, *Silcock 1430* (IND, MEL); *ibid*, Jun 2015, *Silcock s.n.* (MEL); *ibid*, May 2017, *Albrecht 15027* (CANB).

***Distribution and habitat*:** *Lobelia fenshamii* occurs at two spring complexes in central Queensland (near Barcaldine and near Clermont) and one in south-central Queensland (near Eulo). These sites are in the Mitchell Grass Downs, Desert Uplands and Mulga Lands bioregions (Department of the Environment and Energy 2013) respectively.

Lobelia fenshamii is confined to shallow pools and seepage areas formed from artesian springs. The associated vegetation is sedgy grassland or shallow aquatic herbland with commonly associated species including *Cyperus laevigatus* L., *Eragrostis fenshamii* B.K.Simon, *Eriocaulon carsonii* F.Muell., *Fimbristylis dichotoma* (L.) Vahl, *F. ferruginea* (L.) Vahl, *Myriophyllum artesium* Halford & Fensham, *Sporobolus pamelae* B.K.Simon and *Utricularia fenshamii* R.W.Jobson. The soils are neutral-alkaline clayey sands and remain permanently wet.

***Phenology*:** Flowers have been noted all year round.

***Notes*:** *Lobelia fenshamii* has been informally known as *Isotoma* sp. (Myross R.J.Fensham 3883) (Forster 2007, 2010, 2018, 2019), sharing with other species of *Isotoma* an entire, or very shortly cleft corolla tube. Preliminary molecular data indicate that *L. fenshamii* is sister to *L. fontana* (described herein) (Knox *et al.*, unpublished data). It most resembles *Isotoma fluviatilis* (with three subspecies currently recognised) and *Lobelia fontana*, in having flowers with an entire (or very nearly entire) corolla tube and prostrate, mat-forming habit. The generally wet habitat is common to all three species. It differs from all three subspecies of *I. fluviatilis* in its slightly more actinomorphic, smaller corollas (1.5–2.8 mm long, vs. 3–16 mm long for *I. fluviatilis*) that lack both contrasting yellow–green patches in the throat and a contrasting darker transverse colour band towards the base of the lower 3 lobes, shorter calyx lobes (0.3–0.6 mm long, vs. (0.5–)0.7–2.5 mm long), almost entirely connate staminal filaments (vs. connate for less than half their length) that are wholly free of the corolla (vs. adnate for 0.9-4 mm) and in its indehiscent (vs. dehiscent) fruits. Further differences are apparent for individual

Fig. 1. ***Lobelia fenshamii***, showing flowers, immature fruits and leaf variation (cultivated plant ex *Albrecht 15027*, CANB). Photo: D. Albrecht.

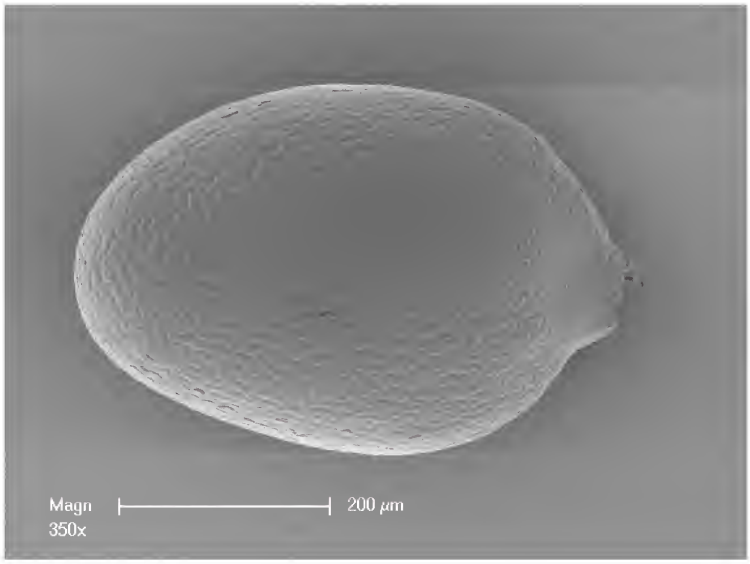

Fig. 2. ***Lobelia fenshamii*** seed (population voucher *Silcock s.n.*, MEL).

subspecies of *I. fluviatilis*; for example, flowers are unisexual in subsp. *fluviatilis* (vs. bisexual in *L. fenshamii*) and the lower three corolla lobes have conspicuous spreading hairs on the adaxial surface in *I. fluviatilis* subsp. *australis* McComb and *I. fluviatilis* subsp. *borealis* McComb (vs. glabrous in *L. fenshamii*). All populations of *I. fluviatilis* are at least 650 km away from the closest population of *L. fenshamii*. *Lobelia fenshamii* differs from *L. fontana* in its smaller corollas (1.5–2.8 mm long, vs. 6–9.5 mm long), shorter hypanthium (1.5–2.1 mm long, vs. 3.5–7 mm long), shorter calyx lobes (0.3–0.6 mm long, vs. 1.1–1.8 mm long), shorter anther tube (0.7–1 mm long, vs. 1.5–2 mm long), absence of bracteoles (vs. present but minute), shorter and differently shaped fruits (2–3 mm long and obovoid to broadly ellipsoid or globose, vs. > 4.5 mm long and obconical) that tend to be downturned into the soil rather than prostrate on it and seeds with a vermiculate (vs. areolate) surface pattern. *Lobelia fenshamii* superficially resembles some forms of the variable *L. irrigua*, but that species has unisexual flowers, a deeply cleft corolla tube, shortly connate staminal filaments, longer fruits (5–8 mm long) and seeds with a reticulate-alveolate surface pattern.

***Conservation status*:** *Lobelia fenshamii* is known from three localities, none larger than 6 km^2; *c.* 100 km north of Barcaldine ('Edgbaston' and adjacent 'Myross'), *c.* 165 km NW of Clermont ('Doongmabulla') and *c.* 35 km NE of Eulo ('Yowah Creek'). The distance between the northernmost and southernmost localities is about 665 km. Eighteen subpopulations are distributed between Edgbaston/Myross (14) and Doongmabulla (4), while the Yowah Creek locality consists of a single subpopulation, but is the largest of all the subpopulations. There have been extensive surveys of springs of the Great Artesian Basin suggesting further populations are unlikely to be found, but it is likely that other populations existed prior to stocking and establishment of bores (Commonwealth of Australia 2014; Fensham *et al.* 2016b).

The Myross and Yowah Creek subpopulations occur on properties managed primarily for cattle. The Doongmabulla property is also managed for stock but the subpopulations are protected by a Nature Refuge Agreement. The subpopulations located on the Bush Heritage Australia property 'Edgbaston' are managed for conservation (R. Fensham pers. comm.).

Approximately half of the artesian springs recorded from Queensland have ceased to flow since European settlement due to water extraction through artificial bores, including many in the Barcaldine supergroup, which includes Doongmabulla and Edgbaston (Fensham *et al.* 2016a; Fahey *et al.* 2019). A government bore-capping program has helped to reduce the dramatic decline in functional springs; however, the exact outcomes of this program have not been evaluated (GABCC 2014). An impending threat to the Doongmabulla population is potential draw-down associated with the development of the Adani Carmichael Mine (Fensham *et al.* 2016b; Currell *et al.* 2017).

Although apparently not grazed, *Lobelia fenshamii* may become trampled into the ground where the population density of cattle or goats is high and/or concentrated on springs. Pigs remain a minor threat at some sites. Applying IUCN criteria (IUCN 2012), the risk assessment produces a result for *L. fenshamii* of **Endangered** (EN, B2ab), based on Area of Occupancy (AOO) <250 km^2, fragmented occurrence – fewer than 10 locations, and projected continuing reduction in area of occupation, number of subpopulations and mature individuals. This species is currently listed as **Vulnerable** under the Queensland *Nature Conservation Act 1992.*

Attempts to cultivate the species have been successful in the short, but not long term. It is recommended that seeds are collected and stored in a recognised seed bank, and that research is undertaken to understand germination requirements.

***Etymology*:** The specific epithet honours Dr Rod Fensham of the Queensland Herbarium (BRI) and Department of Biological Sciences, The University of Queensland (UQ), whose outstanding ecological research on artesian springs has been instrumental in drawing attention to the importance of conserving these unique environments.

2. Lobelia fontana Albr. & N.G.Walsh **sp. nov.** with affinity to *Isotoma fluviatilis*, differing in its corolla lacking both contrasting yellow-green patches in the throat and a contrasting darker transverse colour band towards the base of the lower 3 lobes (rarely a very faint pinkish line transverses the base of the central lobe of the lower lip), often longer hypanthium, staminal filaments connate for greater than half their length and indehiscent fruits. Also with affinity to *Lobelia fenshamii*, differing in its larger corolla, longer hypanthium, longer calyx lobes, longer anther tube, presence of minute bracteoles, longer obconical fruits that tend to be prostrate on the soil surface and seeds with a different surface pattern. **Typus:** Queensland. Gregory North District: Elizabeth Springs, *c.* 100 km SE of Boulia, 24 February 1999, *R.J. Fensham 3676* (holo: BRI [1 sheet & spirit material]).

Isotoma sp. (Elizabeth Springs R.J.Fensham 3676); Forster (2018, 2020).

Herbaceous semi-aquatic rhizomatous perennial *forb*, prostrate and mat-forming, rooting at the nodes. *Stems* terete, straight to weakly zig-zagged, glabrous. *Leaves* distichous, alternate, sessile or with a petiole-like base to *c.* 2.5 mm long; lamina obovate or elliptic, rarely ovate, flat, rather thick-textured, 4–13.5 mm long, (1.5–)2–6.5(–7.2) mm wide, l:w ratio 1.5–2.5:1, glossy green, glabrous, margins entire or with few minute inconspicuous teeth or indentations, the teeth or indentations corresponding with position of a gland, apex obtuse to rounded, with a minute embedded apical gland, base attenuate or gradually tapered to a petiole-like base. *Flowers* bisexual, solitary in axils. *Bracteoles* linear, 0.1–0.3 mm long, inconspicuous at base of pedicel. *Pedicels* 2.5–13 mm long, not or scarcely elongating in fruit, shorter or longer than subtending leaf, glabrous, tending to be prostrate in fruit. *Hypanthium* cylindric-obconical to obconical, narrowed abruptly just below calyx lobes, 3.5–7 mm long, 1.7–2.5 mm wide, glabrous. *Calyx lobes* erect in flower and fruit, narrowly triangular to triangular, 1.1–1.8 mm long, glabrous, entire. *Corolla* very weakly zygomorphic, almost actinomorphic, very weakly 2-lipped, 6–9.5 mm long, wholly and evenly white to pale cream except for an inconspicuous green region at the base of the tube internally, rarely with either a very faint pinkish tinge on the external surface of the tube or lobes, a faint touch of pink near the sinuses between the lobes or a very faint pinkish transverse line across the base of the central lobe of the lower lip; upper lip 2-lobed, the lobes triangular-lanceolate to elliptic, 4–6.2(–7.2) mm long, 1–2 mm wide, spreading with recurved acute tips, glabrous; lower lip 3-lobed, the lobes basally fused for (0–)0.3–1.3 mm above sinus with upper lip, lobes triangular, broadly lanceolate or elliptic, 3.7–6.5 mm long, 1–2.2 mm wide, spreading with recurved acute tips, glabrous; tube 2.3–3.5 mm long, 1.2–1.8 mm diameter at base broadening to 1.5–3 mm diameter at apex, weakly cleft on dorsal side to within 2–3.2 mm of base, glabrous externally, with spreading to reflexed hairs towards the base internally. *Staminal filaments* 3–4.2 mm long, connate distally for (1.5–)2–3.5 mm, although the connate part readily splitting between the filaments, adnate to the base of the corolla tube for 0.2–1.7 mm, glabrous or with sparse inconspicuous hairs on inner surface. *Anther tube* fully exserted beyond dorsal corolla tube sinus, 1.5–2 mm long, greyish-blue to purplish or yellow-brown, glabrous except around the apical orifice, two ventral anthers each with an apical seta 0.25–0.5 mm long and an associated tuft of finer hairs 0.05–0.2 mm long, dorsal anthers glabrous apically. *Style* glabrous; stigmatic lobes 2, elongate-hemispherical. *Fruit* obconical, not or slightly compressed laterally, 4.5–5.5 mm long (but possibly up to *c.* 8 mm), 2.2–2.5 mm wide, glabrous, veins not evident; apical portion raised 0.6–1.3 mm above the rim of the hypanthium, apparently indehiscent and releasing seeds through rupture or rotting of the fruit walls; persistent calyx lobes erect,

Fig. 3. ***Lobelia fontana***, showing flowers and immature fruits (population voucher *Fensham 6411*, BRI). Photo: S. Peck.

Fig. 4. ***Lobelia fontana*** flower (cultivated plant ex *Jobson 2626*, NSW). Photo: A.E. Orme.

Fig. 5. ***Lobelia fontana*** immature fruit with withered corolla (cultivated plant ex *Jobson 2626*, NSW). Photo: A.E. Orme.

Fig. 6. ***Lobelia fontana*** seed (population voucher *Jobson 2626*, NSW).

not accrescent. *Seeds* mid-brown, ellipsoid to broadly ellipsoid, slightly compressed, 0.55–0.6 mm long, *c.* 0.45 mm wide; testa with a network of ridges enclosing irregular spaces (areolate). **Figs. 3–6**.

***Additional specimens examined*: Queensland.** GREGORY NORTH DISTRICT: Elizabeth Springs, Mar 2014, *Fensham 6411*, (BRI); *ibid*, Apr 2015, *Jobson 2626* (NSW).

***Distribution and habitat*:** *Lobelia fontana* is known only from Elizabeth Springs in central western Queensland (SE of Boulia) in the Mitchell Grass Downs bioregion (Department of the Environment and Energy 2013). This population is very isolated with no other Campanulaceae: *Lobelioideae* recorded within at least a 150 km radius of Elizabeth Springs.

Lobelia fontana is restricted to seepage areas formed from artesian springs. It occurs in sedgy grassland, particularly where the vegetation is short, and is commonly associated with *Eragrostis fenshamii*, *Cyperus laevigatus*, *Eriocaulon carsonii*, *Fimbristylis dichotoma* and *Utricularia ameliae* R.W.Jobson. The soils are mineralised clayey sands and remain permanently wet.

***Phenology*:** Flowers have been noted from October to May; however, observations are limited and it may have a more extended flowering season.

***Notes*:** *Lobelia fontana* has been informally known as *Isotoma* sp. (Elizabeth Springs R.J. Fensham 3676) (Forster 2018, 2020), sharing with other species of *Isotoma* a very shortly cleft corolla tube. Preliminary molecular data indicate that *L. fontana* is sister to *L. fenshamii* (Knox *et al.*, unpublished data). It most resembles *Isotoma fluviatilis* (with three subspecies currently recognised) and *Lobelia fenshamii* (described herein), in having flowers with a very weakly cleft corolla tube and prostrate, mat-forming habit. The generally wet habitat is common to all three species. It differs from all three subspecies of *I. fluviatilis* in its corolla lacking both contrasting yellow-green patches in the throat and a contrasting darker transverse colour band towards the base of the lower three lobes (rarely a very faint pinkish line traverses the base of the central lobe of the lower lip), often longer hypanthium (3.5–7 mm long, vs. 1–4.5 mm long in *L. fluviatilis*), staminal filaments connate for greater than half their length (vs. connate for less than half their length) and indehiscent (vs. dehiscent) fruits. Further differences are apparent for individual subspecies of *I. fluviatilis*, for example flowers are unisexual in *I. fluviatilis* subsp. *fluviatilis* (vs. bisexual in *Lobelia fontana*) and the lower three corolla lobes have conspicuous spreading hairs on the adaxial surface in *I. fluviatilis* subsp. *australis* and *I. fluviatilis* subsp. *borealis* (vs. glabrous in *L. fontana*). The nearest population of *I. fluviatilis* to Elizabeth Springs is *c.* 1200 km to the south east. *Lobelia fontana* differs from *L. fenshamii* in its larger corollas (6–9.5 mm long, vs. 1.5–2.8 mm long), longer hypanthium (3.5–7 mm long, vs. 1.5–2.1 mm long), longer calyx lobes (1.1–1.8 mm long, vs. 0.3–0.6 mm long), longer anther tube (1.5–2 mm long, vs. 0.7–1 mm long), presence (vs. absence) of minute bracteoles, longer differently shaped fruits (> 4.5 mm long and obconical, vs. 2–3 mm long and obovoid to broadly ellipsoid or globose) that tend to be prostrate on the soil surface rather than downturned into the soil and seeds with surface ridges that are not strongly wavy (vs. vermiculate). The nearest population of *L. fenshamii* to Elizabeth Springs is at Edgbaston *c.* 500 km due east south east.

The description of *Lobelia fontana* is based on rather limited material, especially with respect to fruits and seeds.

***Conservation status*:** *Lobelia fontana* is known from a single location and is the most restricted of all Queensland artesian spring endemics. Its extent of occurrence is estimated to be as low as 0.09 km^2, with the largest patch being only *c.* 25 m^2 (S. Peck pers. comm., 2010). Determining the number of plants present is difficult due to the growth habit of the species and molecular techniques may be required to establish how many genotypes are contained in the population. A working estimate of < 100 individuals is presently being used. The entire population occurs within the Elizabeth Springs Conservation

Park, which is fenced to exclude livestock and feral pigs. However, the fence has been breached on at least one occasion and it is unlikely that difficulties in maintaining secure fencing will be overcome in the foreseeable future (R. Fensham pers. comm.). Digging by pigs remains a potential significant threat as a single serious event could render the species extinct. Regular checks for fence breaches and pig damage within the conservation park should continue indefinitely and management actions undertaken immediately as required. Applying IUCN criteria (IUCN 2012), the risk assessment produces a result for *L. fontana* of **Critically Endangered** (CR). *Lobelia fontana* qualifies as CR based on B2ab (AOO < 10 km^2, known to exist at a single location, and projected continuing decline in area of occupation, quality of habitat and mature individuals) and C2aii (population size < 250 mature individuals, with a projected decline in population size, and all mature individuals occurring in a single population). This species is currently listed as **Endangered** under the Queensland *Nature Conservation Act 1992.*

Attempts to cultivate *Lobelia fontana* have achieved similar results to those for *L. fenshamii* with some short, but not long-term success. It is recommended that seeds are collected and stored in a recognised seed bank as a matter of urgency, and that research is undertaken to understand germination requirements.

***Etymology*:** The specific epithet is from the Latin *fons*, spring of water, in reference to the artesian spring habitat of this species.

Acknowledgements:

We are grateful to Rod Fensham (BRI, UQ) for drawing our attention to the two new species, for collecting live material and for providing information on their ecology and conservation status; to Jen Silcock (UQ), Stephen Peck (QLD Parks & Wildlife Service) and Gabrielle Lebbink (UQ) for collecting live material; to Stephen Peck and Andrew Orme (National Herbarium of New South Wales) for providing images; to Chris Cargill for assistance with SEM imagery; to nursery staff of the ANBG and ASDP for their interest and perseverance in trying to grow these species, and to the director of BRI for the loan of specimens.

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Denhamia megacarpa J.J.Halford & Jessup and *D. peninsularis* J.J.Halford & Jessup (Celastraceae), two new species from Queensland

J.J. Halford & L.W. Jessup

Summary

Halford, J.J. & Jessup L.W. (2020), *Denhamia megacarpa* J.J. Halford & Jessup and *D. peninsularis* J.J. Halford & Jessup (Celastraceae), two new species from Queensland. ***Austrobaileya* 10(4): 594–603**. Two new species of *Denhamia* Meisn. are described, *viz. D. megacarpa* J.J.Halford & Jessup, *D. peninsularis* J.J.Halford & Jessup, and the new combination, *D. muelleri* (Benth.) Jessup is made based on *Celastrus muelleri* Benth. The two new species are illustrated and notes are provided on distribution, habitat and conservation status. An identification key to Australian *Denhamia* is provided.

Key Words: Celastraceae; *Denhamia*; *Denhamia megacarpa*; *Denhamia muelleri*: *Denhamia peninsularis*; Australia flora; Queensland flora; taxonomy; identification key; conservation status

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Introduction

The genus *Denhamia* Meisn. (Celastraceae) consists of 15 species of trees and shrubs distributed across Australia and the western Pacific. Following inference based on molecular and morphological studies (Simmons *et al.* 2008), the genus has been expanded to incorporate the Austral-Pacific *Maytenus* Molina (McKenna *et al.* 2011), from which it was previously separated on locule and ovule numbers (e.g. Jessup 1984). Thirteen species occur in Australia with ten occurring in Queensland.

In this paper we describe two new species of *Denhamia* from Queensland, Australia, that have capsular fruit with 2–5 locules and 2–10 ovules, features on which the genus was originally circumscribed. *Denhamia megacarpa* has a highly restricted occurrence, known only from several isolated subpopulations from tablelands in central Queensland, whereas *D. peninsularis* is restricted to northern Cape York Peninsula, Queensland. A key to Australian *Denhamia* is provided to demonstrate the characteristics that separate the newly described species from all others.

Simmons in McKenna *et al.* (2011) made an invalid combination in publishing the name *Denhamia ferdinandii* when an earlier epithet should have been used for this species. The correct new combination for this is made below.

Materials and methods

Dried and spirit collections were examined of the undescribed *Denhamia* species held at the Queensland Herbarium (BRI) and all closely related taxa. Measurements were made from dried material with the exception of floral components from which measurements were taken from material in spirit. Targeted field surveys for *D. megacarpa* were carried out at known locations and suitable habitat, on four separate occasions between May 2014 and April 2019 (see Halford 2019 for details) to supplement the morphological examinations.

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Measurements are inclusive in the descriptions, i.e. 1.0–1.7 is given as 1–1.7. National Park is abbreviated as NP in the specimen citations.

Taxonomy

1. Denhamia megacarpa J.J.Halford & Jessup **sp. nov.** With affinity to *D. oleaster* (Lindl.) F.Muell., but differing by the longer, narrower leaves (5–12.5 × 0.5–2 cm) with a thick waxy cuticle on the lower surface, a more complex and expansive inflorescence and larger fruits (2.9–5.5 cm long). **Typus:** Queensland. LEICHHARDT DISTRICT: Mackenzie (tableland), *c.* 5 km along Karramarra Road from Willie Creek – Royles Road, 16 April 2019, *J.J. Halford JJH635 & S. Bush* (holo: BRI; iso: CANB, K).

Denhamia sp. (Junee Tableland T.J.McDonald 553); Jessup (1997: 45; 2002: 44; 2007: 44; 2010: 39); Jessup & Halford (2020).

Shrub or tree to 8 m tall, glabrous; the trunk white to pale grey, mottled, often becoming deeply fluted at the base; branchlets pendulous. Leaves coriaceous and stiff, with a thick, white, waxy cuticle below making them strongly discolorous; stipules linear-triangular, 0.2–0.5 mm long, caducous. Juvenile and coppicing leaves with petioles 0.2–0.4 cm long; lamina similar to adult form, but with distinctly toothed margins and a pungent tip, to 19.5 cm long and 0.8–1.5 cm wide. Adult leaves with petioles 0.3–1.3 cm long; lamina lanceolate, linear or falcate to narrowly elliptic, occasionally narrowly oblanceolate; venation obvious and distinctly raised on the upper side with numerous secondary veins and prominent reticulate tertiary veins, less so beneath and partly obscured by the cuticle, 5–12.5 cm long and 0.5–2 cm wide, margins entire to shallowly or occasionally toothed, gradually or abruptly drawn to a blunt or pungent tip, the mucro to 0.9 mm long where present. Inflorescence an axillary, many-flowered, compound cyme to 5.5 cm long; pedicels 4–11 mm long; flowers 5-merous; sepals semicircular, rounded or oblong and concave, 1–1.5 mm long; petals oblong-obovate and slightly convex, 4–5 mm long, cream to a pale greenish-yellow; staminal filaments 1.5–2.5 mm long, anthers ± latrorse; ovary mostly exposed above disk, imperfectly 3 (rarely 2–4)-locular with 8–10 ovules per locule; style 1–1.5 mm long; stigma undivided or shortly 3-lobed. Capsules ovoid (rarely obovoid), elongated, 2.9–5.5 cm long and at least to 2.3 cm wide prior to dehiscence, ripening yellow; valves woody, 2–5 mm thick, the septa not touching axially, containing several seeds 5–6 mm long enveloped in a fleshy red aril. **Fig. 1**.

***Additional selected specimens examined*: Queensland.** SOUTH KENNEDY DISTRICT: *c.* 5 km W of Newlands Mine, N of Glenden on Suttor North Station, Apr 2005, *Harris WKIH2161* (BRI). LEICHHARDT DISTRICT: Eagle Point, Junee Tableland, N of Dingo, Oct 2002, *Bean 19387* (BRI); Junee Tableland, 80 km N of Dingo, Jun 1972, *McDonald 553* (BRI); Junee Tableland, NW corner, Nov 2015, *Halford JJH444 & Bush* (BRI); NW escarpment, Junee NP, North of Dingo, Feb 2006, *Bean 24633* (BRI); Junee Tableland, NW corner, May 2014, *Halford JJH356 & Williams* (BRI); Junee Tableland, N of Dingo, Nov 1990, *Bean 2621* (BRI); Mackenzie (tableland), *c.* 3 km along Coreen Road from Willie Creek – Royles Road, Apr 2019, *Halford JJH634 & Bush* (BRI); SE of Mackenzie River, Feb 1993, *Fensham 446* (BRI); *c.* 50 km N of Dingo, *s.dat.*, *Bunn TRIK* (BRI); Burkan, *c.* 11.75 km along Burkan Road, from turnoff at Alsace, Apr 2019, *Halford JJH633 & Bush* (BRI).

***Distribution and habitat*:** *Denhamia megacarpa* is known from three subpopulations in eastern central Queensland, those being the tableland at the locality of Mackenzie, north of Dingo; the Junee Tableland near Middlemount where it was first recorded in 1972 and an outlying subpopulation at Newlands, west of Mackay (see **Map 1**). These three subpopulations are geographically isolated, confined to separate geological features that are in effect, ecological islands. The Mackenzie and Junee subpopulations are separated by a distance of approximately 50 km by the cleared and highly modified Mackenzie River floodplain. The Newlands subpopulation lies approximately 205 km north of the Junee subpopulation. These subpopulations are considered to be genetically isolated from each other (Halford 2019). Only the Junee subpopulation is currently protected within the reserve system (one location in Junee National Park, one location in Junee State Forest).

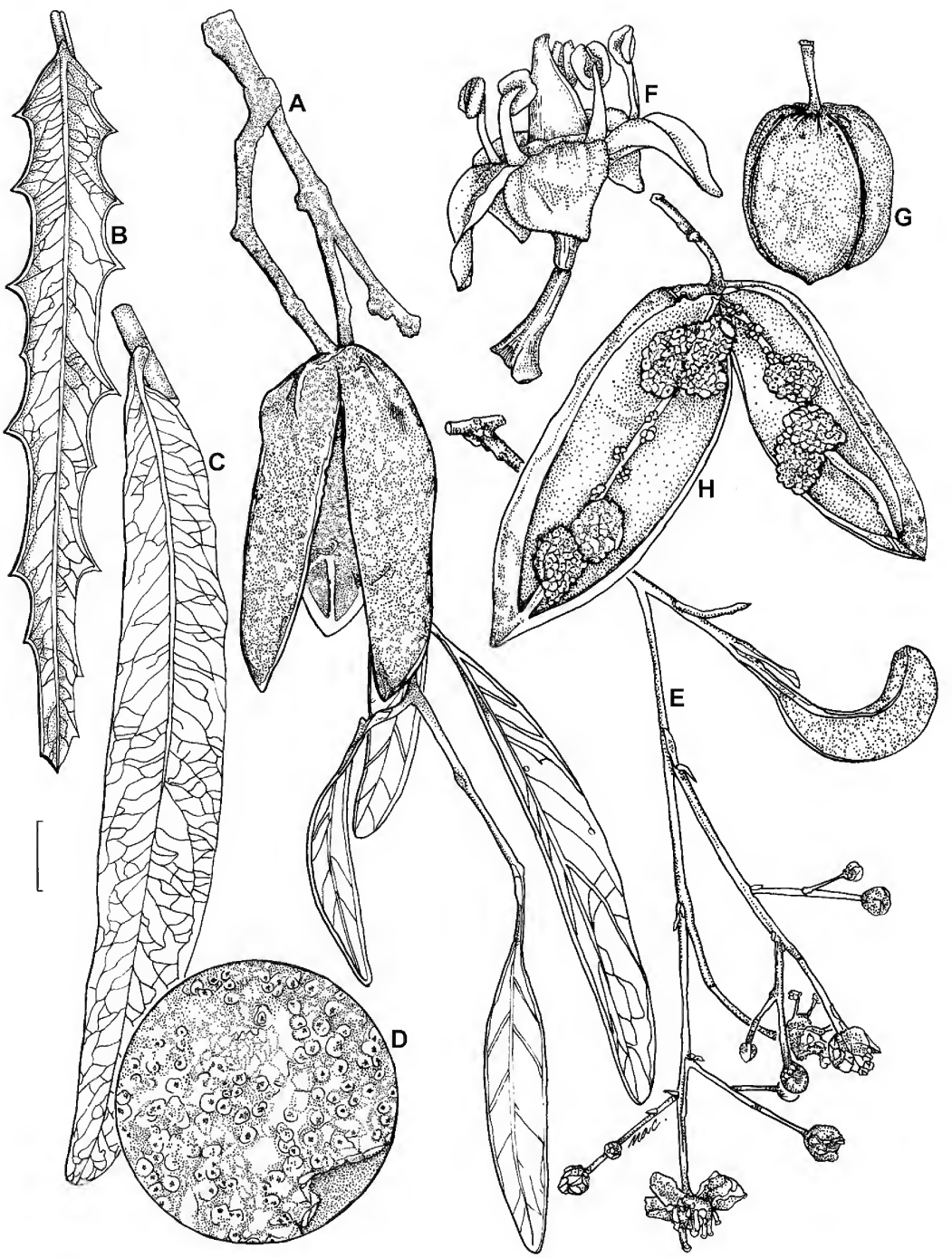

Fig. 1. ***Denhamia megacarpa***. A. pendulous habit of branchlet with persistent dehisced capsule ×1. B. juvenile leaf ×1. C. adult leaf ×1. D. cuticle detail on abaxial side of leaf ×40. E. inflorescence ×1.25. F. flower ×5. G. fruit (insect infested and failing to reach maturity) ×1. H. dehisced fruit with seed enclosed in aril ×1.25. A from *Halford JJH634 & Bush* (BRI); B–D & G from *Halford JJH356 & Williams* (BRI); E from *Halford JJH635 & Bush* (BRI); F from Halford *JJH444 & Bush* (BRI); H from *Bunn TRIK* (BRI). Scale bar = 10 mm at ×1 magnification. Del. N. Crosswell.

Denhamia megacarpa favours shallow, Cainozoic lateritic duricrusts on or near steep upper slopes at the edge of the tablelands in association with *Acacia shirleyi* Maiden and/or *A. catenulata* C.T.White (Regional Ecosystem (RE) 11.7.2, see Queensland Herbarium 2019 for description), or immediately adjacent upon the tablelands in woodland of *Eucalyptus crebra* F.Muell. and *Corymbia brachycarpa* (D.J.Carr & S.G.M.Carr) K.D.Hill & L.A.S.Johnson (RE 11.5.9b), usually on deeper Cainozoic sandplains. This habitat preference is strongly apparent at Junee Tableland where, based on current search effort, the species is confined to the north-west corner of the tableland. The Mackenzie subpopulation is the most populous (a density of *c.* three individuals per hectare where present) although this subpopulation maintains a patchy distribution with individuals clustered mostly adjacent to, and always within 1 km of the escarpment.

***Phenology*:** Flowers have been recorded in November and April, while mature fruits have been recorded in February.

***Notes*:** *Denhamia megacarpa* appears to be most similar to *D. oleaster* but differs from that species by having longer and narrower leaves (4–8 cm long and 1–3.5 cm wide in *D. oleaster*) with a very thick waxy cuticle on the lower surface; usually a more complex and more open inflorescence with more extensive and longer branches and longer pedicels (4–11 mm long in *D. megacarpa*, < 4 mm long in *D. oleaster*); and an elongated capsule to 5.5 cm long (to 2.8 cm long in *D. oleaster*) with a notably thick wall to 0.5 cm (to < 2mm in *D. oleaster*).

Denhamia megacarpa occurs within the eastern extent of the widespread *D. oleaster* with that species favouring soils of higher clay content that support vegetation communities with more closed structures such as vine thickets and forests dominated by brigalow (*Acacia harpophylla* F.Muell ex Benth.). *D. megacarpa* appears to favour shallower sands and lateritic surfaces – the relatively accentuated sclerophyllous composition of the leaf of *D. megacarpa* a likely adaptation to nutrient poor soils (Beadle 1966; Read & Sanson 2003) with the thick waxy cuticle on the abaxial leaf surface a possible adaptation to a more xeric environment (Schreiber & Riederer 1996) to that of *D. oleaster*. The two species have not been observed co-occurring (JJH pers. obs.).

Denhamia megacarpa also appears to be similar to *D. obscura* (A.Rich.) Meisn. ex Walp but differs mostly from that species by its longer and narrower leaves, particularly in the juvenile stage (to 15 cm long and 6 cm wide in *D. obscura*) and a thicker lamina with more prominent venation. *D. megacarpa* generally develops a more open inflorescence with pedicels 4–11 mm in length (1–3.5 mm in length within *D. obscura*), flowers with longer filaments (1.5–2.5 mm compared to < 1 mm in *D. obscura*) and a more pronounced style (1–1.5 mm in length compared to little or no style in *D. obscura*. Mature fruits of *D. megacarpa* are longer, more elongated and ovoid or obovoid (shorter, broader and more globose in *D. obscura*). The two species are allopatric with *D. obscura* occuring in the top end of the Northern Territory and adjacent northern Western Australia – the closest occurrence *c.* 1400 km north-west of *D. megacarpa*.

Denhamia megacarpa probably has naturally low fertility rates. This could in part be due to high levels of predation of buds, flowers and fruits by insect larvae, observed in the field and on preserved specimens. Despite the first collection of this taxon in 1972, a paucity of quality fertile herbarium material exists and only recently have flowering specimens been obtained. Recruitment is considered to be low with no juvenile plants observed during the most recent surveys.

***Conservation status*:** Based on the IUCN (2012) criteria, this species has been nominated by Halford (2019), under the hispid name *Denhamia* sp. (Junee Tableland T.J.McDonald 553), as **Endangered** – EN A4 (a); B1&B2 a, b (iii, v); C1.

The overall population size for *Denhamia megacarpa* is estimated at < 1000 mature individuals. It is considered to be naturally rare with a highly fragmented population. The landscape within the extent of occurrence for *D. megacarpa* has been extensively modified for grazing and to a lesser extent, mining and cropping and as such, the subpopulations at Newlands and Mackenzie have been exposed to historic and ongoing threats of land clearing. Mining interests occur over the Junee State Forest and the tableland at the location of Mackenzie and mining activities are ongoing in the vicinity of the Newlands subpopulation. Despite a preference for xeric environments, *D. megacarpa* is sensitive to the effects of fire with high intensity fire resulting in mortality or crown death followed by coppicing from the lower trunk, with no suckering evident (JJH pers. obs.). Fires that are too frequent and/or high in intensity pose a serious threat (Halford 2019).

***Etymology*:** The species epithet is given in reference to the fruits that are the largest known in the genus.

2. Denhamia peninsularis J.J.Halford & Jessup **sp. nov.** With affinity to *D. celastroides* (F.Muell.) Jessup, but differing by the stiffer and generally shorter and broader leaves, longer pedicels, shorter styles and larger fruits. **Typus:** Queensland. Cook District: 16.8 km NE of Heathlands by road, 29 February 1992, *J.R. Clarkson 9256 & V.J. Neldner* (holo: BRI; iso: K).

Denhamia sp. (Jardine River B.P.Hyland 10250); Jessup (1997: 45; 2002: 44; 2007: 44; 2010: 39); Jessup & Halford (2020).

Denhamia sp. (Jardine River Mouth BH 10250); Hyland *et al.* (1994, 1999: 60).

Denhamia sp. (Jardine River Mouth); Cooper & Cooper (2004: 114).

Shrub or small tree to 5 m tall, glabrous, the trunk mottled grey; young branchlets subtly striate. Leaves alternate and often crowded near the ends of branchlets, coriaceous, stiff, discolorous; stipules linear-triangular, 0.25–0.3 mm long, caducous. Juvenile leaves with petiole 0.5–0.7 cm long; lamina to 11.5 cm long and 4 cm wide, with shallowly toothed margins. Adult leaves with petiole 1.5–4 mm long; lamina oblanceolate to obovate (occasionally lanceolate to elliptic), rarely obcordate, attenuate at the base; venation raised on both surfaces with 8–14 secondary pairs, 3–9 cm long, 1.1–3.7 cm wide; margins serrate to serrulate, sometimes obscure, mucronate to (rarely) retuse. Inflorescence a many flowered cyme to 7 cm long, pedicels 1.7–3 mm long. Flowers 5-merous, sepals rounded to ovate and concave, entire or sometimes erose, occasionally cuspidate, 1–1.5 mm long; petals oblong-obovate to rounded, concave, occasionally cuspidate, 2.5–4 mm long, cream to a pale yellow in colour, staminal filaments 1.2–1.8 mm long, anthers latrorse, ovary mostly exposed above disk, imperfectly 3 (rarely 2–4)-locular with 2–4 ovules per locule, style 1.2–1.7 mm long, stigma 3-lobed. Capsules ovoid, to 1.6–2.4 cm long when mature and at least to 14 mm wide prior to dehiscence, ripening through yellow to orange, valves woody, 1–2 mm thick, the septa not touching axially, containing several seeds 3–5 mm long, mostly enveloped in a fleshy red aril. **Fig. 2**.

***Additional selected specimens examined*: Queensland.** Cook District: Jardine River Mouth, Feb 1980, *Hyland 10250* (BRI); Turtle Head Island, May 1995, *Le Cussan 416* (BRI); Cape York, N of Jardine River *c.* 32 km SE of Bamaga, Oct 1971, *Dodson s.n.* (BRI [AQ003618]); Cockatoo Creek at Old Telegraph Line crossing, Mar 1992, *Clarkson 9328 & Neldner* (BRI); 91.3 km SSE of Bamaga, Oct 1993, *Fell DGF3674 & Dibella* (BRI); 5 km W of Shelburne Bay, 7 km NE of Red Cliffs, Cape York Peninsula, Jun 2008, *Forster PIF33873 & McDonald* (BRI); 3 km S of Shelburne Bay, 8 km W of Thorpe Point, Cape York Peninsula, Jun 2008, *Forster PIF33817 et al.* (BRI); Cape York Peninsula, Shelburne Bay area *c.* 1.5 km S from MacMillan River crossing track to White (Wolona) Point, Jul 1990, *Purdie 3700* (BRI); 6 km N of Olive River Mouth, Apr 1994, *Fell DGF4226 et al.* (BRI); N of Olive River Mouth, Sep 1974, *Tracey 14472* (BRI); Olive River, Sep 1974, *Hyland 7446* (BRI); 3.5 km from beach turnoff from Bolt Head on track to Bromley Station, Jul 1990, *Clarkson 8845 & Neldner* (BRI); Temple Bay, Bolt Head, Jun 1996, *Forster PIF19366* (BRI).

***Distribution and habitat*:** *Denhamia peninsularis* is restricted to northern Cape York Peninsula from Bolt Head north to the Jardine River south of Bamaga (**Map 2**). It occurs at low elevations in dense shrublands

Fig. 2. ***Denhamia peninsularis***. A. branchlet with inflorescence ×1.5. B. juvenile leaf ×1. C. adult leaf ×1. D. flower ×8. E. branchlet with fruit ×1. partially dehisced fruit ×2. G. dehisced fruit with seed enclosed in aril ×2. A from *Le Cussan 416* (BRI); B from *Fell DGF3674 & Dibella* (BRI); C & G from *Dodson s.n.* (BRI [AQ003618]); D from *Forster PIF19366* (BRI); E from *Hyland 10250* (BRI). Scale bar = 10 mm at ×1 magnification. Del. N. Crosswell.

or low forests as closed heaths (e.g. REs 3.3.53a, 3.5.42, 3.2.17 and 3.2.18), or simple notophyll vine forests and semi-deciduous microphyll vine thickets in coastal or riparian vegetation in siliceous white sands (e.g. REs 3.3.5a, 3.5.33 and 3.2.12).

***Phenology*:** Flowers have been recorded in February, and May – July, while mature fruits have been collected in February, June, July and October.

***Notes*:** *Denhamia peninsularis* closely resembles *D. celastroides* but the distributions of these species do not overlap. *Denhamia celastroides* occurs no further north than the Windsor Tableland, *c.* 500 km from the southern-most record of *D. peninsularis*. Furthermore, the habitats of the two species differ, with *D. peninsularis* occurring in sands in coastal and riparian vegetation at low altitudes (5–150 m), whereas, in its northern-most limits, *D. celastroides* is confined to higher altitude (600–1200 m) complex notophyll vine forests in granite derived soils. Morphologically these two species differ in their leaf texture and size (stiffer with a smaller lamina length to breadth ratio in *D. peninsularis*), their floral components (a longer pedicel and shorter style in *D. peninsularis*) and mature fruits (capsules larger (1.6–2.4 cm) and ripening orange in *D. peninsularis*, while those of *D. celastroides* are 1–1.7 cm and ripen yellow). Other species of *Denhamia* that occur within the range of *D. peninsularis* are *D. cunninghamii* (Hook.) M.P.Simmons, *D. fasciculiflora* (Jessup) M.P.Simmons and *D. oleaster*, all of which are easily distinguished from each other based on the features outlined in the key below.

***Conservation status*:** *Denhamia peninsularis* occurs in intact vegetation in a generally undeveloped region and is well represented within the reserve system, albeit with a limited extent of occurrence (6693 km²) and area of occupancy (52 km²) (derived using GeoCat: Bachman *et al.* 2011), A listing of **Least Concern** is therefore recommended for this species.

***Etymology*:** The species epithet is given in reference to Cape York Peninsula, the location to where this species is confined.

3. Denhamia muelleri (Benth.) Jessup, **comb. nov.**; *Celastrus muelleri* Benth., *Fl. Austral.* 1: 399 (1863); *Maytenus ferdinandi* Jessup, *Fl. Aust.* 22: 223 (1984); *Denhamia ferdinandi* (Jessup) M.P.Simmons, *Syst. Bot.* 36: 929 (2011) *nom. inval.*; *non Maytenus muelleri* Schwacke.

Key to Australian *Denhamia* species (adapted from Jessup 1984):

1 Ovary perfectly 2 or 3-locular with ovules 2 per locule at base of septa; septa connate, touching axially in fruit; valves of capsules crustaceous (formerly in ***Maytenus***) **2**

1. Ovary perfectly or imperfectly 2–5-locular with ovules 2–10 per locule, not confined to base of septa; septa touching near apex, base connate but otherwise not touching in axially in fruit, valves of capsules mostly woody (***Denhamia*** in the original sense) **7**

2 Aril thick, restricted to base of seed **3**

2. Aril thin, surrounding at least half seed **4**

3 Flowers 4-merous, disc *c.* 1 mm diameter E Qld, NE NSW . . . . . **D. disperma**

3. Flowers 5-merous; disc *c.* 2.3 mm diameter N NT, N WA . . . . . **D. muelleri**

4 Flowers in fascicles. NE Qld . . . . . **D. fasciculiflora**

4. Flowers in racemes **5**

5 Leaves bright green concolorous or rarely discolorous, margins always entire, not recurved. Qld, N NSW, NT and N WA . . . . . **D. cunninghamii**
5. Leaves discolorous, grey-green below, darker above; margins usually serrate, slightly recurved **6**

6 Leaves narrowly lanceolate, narrowly ovate, obovate or oblanceolate, length:breadth 12–4.5:1, apices usually acuminate, mucronate or acute SE Qld, E NSW . . . . . **D. silvestris**
6. Leaves broadly lanceolate, elliptic, ovate or obovate, length:breadth 3–2:1, apices usually obtuse to slightly acuminate. E Qld, NE NSW . . . . . **D. bilocularis**

7 Adult leaves serrate or serrulate, sometimes obscurely so **8**
7. Adult leaves entire **12**

8 Ovary perfectly 3–5-locular; capsule depressed-globular or slightly obovoid; septa connate axially in fruit. E Qld . . . . . **D. pittosporoides**
8. Ovary perfectly or imperfectly 3-locular; capsule ovoid; septa not connate axially in fruit **9**

9 Capsule 2.7–5.5 cm long and walls 3–5 mm thick; style 1–1.5 mm long; lamina below thickly covered in waxy cuticle; petiole 5–13 mm long. Central Qld . . . . . **D. megacarpa**
9. Capsule no greater than 2.4 cm long or walls no greater than 2 mm thick. **10**

10 Style to 0.3 mm long; lamina 0.5–3 cm long; petiole 0.6–1 mm long. SE Qld. . . . . **D. parvifolia**
10. Style greater than 1 mm long; lamina ≥ 3 cm long; petiole > 1 mm **11**

11 Style 1.2–1.7 mm long; pedicel 1.7–3 mm long; lamina 3–9 cm long and 1.1–3.7 cm wide, petiole 1.5–4 mm long; capsule 1.6–2.4 cm long. Cape York, Qld . . . . . **D. peninsularis**
11. Style 2–2.5 mm long; pedicel to 1 mm long; lamina 4–12 cm long and 1–4.5 cm wide, petiole 2–5 mm long; capsule 1–1.7 cm long. E. Qld, NE NSW. . . . . **D. celastroides**

12 Valves of capsules coriaceous; septa at least partially connate or touching axially. NE NSW . . . . . **D. moorei**
12. Valves of capsule woody; septa not touching axially **13**

13 Capsule valves 0.3–0.5 mm thick; petiole 0.6–1 mm long. SE Qld . . . . . **D. parvifolia**
13. Capsule valves 0.9–5 mm thick; petiole 4–13 mm long **14**

14 Filaments 0.5–1 mm long; style very short or obsolete; ovary with 6 ovules per carpel; capsule valves 3–3.5 mm thick. N NT, N WA . . . . . **D. obscura**
14. Filaments ≥ 1.3 mm; style 0.4–1.5 mm long; ovary with 8–10, rarely 6, ovules per carpel **15**

15 Pedicels 4–11 mm long; lamina with a thick waxy cuticle on the abaxial surface; inflorescence a complex cyme; capsule 2.7–5.5 cm long and 3–5 mm thick; petals 4–5 mm long. Central Qld . . . . . **D. megacarpa**

15. Pedicels no more than 4 mm long; lamina lacking a thick waxy cuticle on the abaxial surface; inflorescence a simple cyme or raceme; capsule no greater than 4.5 cm long or 3 mm thick **16**

16 Petals 3–3.5 mm long; capsule ovoid, rarely obovoid, 15–28 mm long; inflorescence many-flowered. N & Central Qld . . . . . **D. oleaster**

16. Petals 3.5–4.5 mm long; capsule fusiform or obovoid, 25–45 mm long; inflorescence 1–3-flowered. NE Qld . . . . . **D. viridissima**

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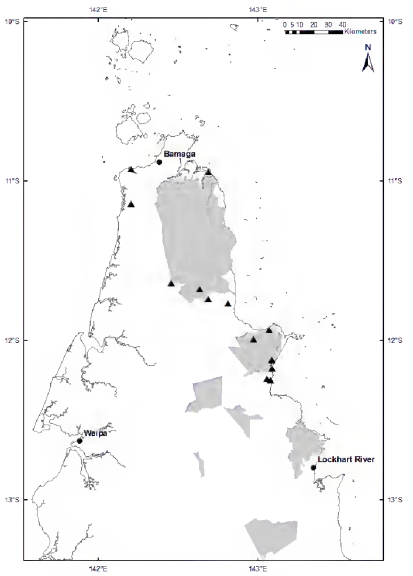
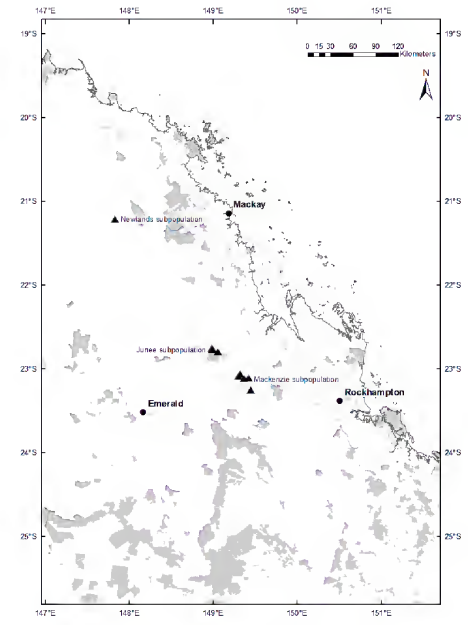


Map 2. Distribution of ***Denhamia peninsularis***.



Map 1. Distribution of ***Denhamia megacarpa***.

A taxonomic reassessment of *Styphelia cuspidata* (R.Br.) Spreng. (Ericaceae) with the description of two new species *S. cognata* A.R.Bean and *S. lucens* A.R.Bean

A.R. Bean

Summary

Bean, A.R. (2020). A taxonomic reassessment of *Styphelia cuspidata* (R.Br.) Spreng. (Ericaceae) with the description of two new species *S. cognata* A.R.Bean and *S. lucens* A.R.Bean. ***Austrobaileya* 10(4): 604–611**. A morphological reassessment of specimens identified as *Styphelia cuspidata* (R.Br.) Spreng. (syn. *Leucopogon cuspidatus* R.Br.) has revealed the existence of three taxa that differ at species rank. In this paper, these three species, all endemic to Queensland, are described, compared and illustrated. Two new species, *Styphelia cognata* A.R.Bean and *S. lucens* A.R.Bean are named.

Key Words: Ericaceae; *Leucopogon*; *Styphelia*; *Styphelia cognata*; *Styphelia cuspidata*; *Styphelia lucens*; Australia flora; Queensland flora; new species; taxonomy

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Introduction

A wide ranging phylogenetic analysis of the Tribe *Styphelieae* of Ericaceae (Puente-Lelièvre *et al.* 2016) confirmed previous studies showing *Leucopogon* R.Br. to be polyphyletic, necessitating either numerous extra generic names, or the merging of many of its species into *Styphelia* Sm. The authors have chosen the second option, arguing that the splitting option would result in the recognition of some genera that had no morphological diagnostic features. Since that paper, Hislop & Puente-Lelièvre (2017) and Crayn *et al.* (2019) have published new species of *Styphelia* using the expanded circumscription. The necessary new combinations in *Styphelia* have recently been published (Crayn *et al.* 2020).

Specimens filed under *Leucopogon cuspidatus* R.Br. (now *Styphelia cuspidata* (R.Br.) Spreng.) were observed by the present author to be heterogeneous, and a detailed examination revealed that three taxa were involved, *S. cuspidata* and two new species, described here as *S. lucens* A.R.Bean and *S. cognata* A.R.Bean.

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Materials and methods

This paper is based on a morphological study of herbarium specimens at BRI, as well as specimen images, indicated as *i.d.v.* (*imago digitalis visa*), held at BM, NSW, K, L, P, G and MEL. All measurements are based on dried material with dimensions inclusive, i.e. 1.0–1.7 is given as 1–1.7.

Morphological characteristics of the three species previously comprising *S. cuspidata sens. lat.* and the putative close relative *S. trichostyla* (J.M.Powell) Hislop, Crayn & Puente-Lel. are compared in **Table 1**.

In the specimen citations, Mountain or Mount is abbreviated as Mt and National Park as NP.

Taxonomy

Styphelia cognata A.R.Bean **sp. nov.** With affinity to *S. cuspidata*, but differing by the shorter and narrower leaves (5.4–9 × 1.5–2.1 mm), the often 1-flowered inflorescences, the narrower fruits (1.4–1.5 mm diameter) and the glabrous style. **Typus:** Queensland. Port Curtis District: Glen Geddes siding forestry reserve, 15 May 1998, *G.N. Batianoff 98059R & T. Ryan* (holo: BRI; iso: AD, DNA, K, MEL, NSW).

[*Styphelia cuspidata* (R.Br.) Spreng. *pro parte*]

Shrub 0.3–1.5 m high. Young branchlets white, grey or brown, with dense hispidulous patent hairs *c.* 0.05 mm long. Older stems glabrescent, with fissured grey to brown bark. Leaves spirally arranged, strongly antrorse, obovate to oblanceolate, the larger ones 5.4–9 × 1.5–2.1 mm, *c.* 0.1 mm thick, apex acuminate (acumen pungent, 0.8–1.6 mm long), base cuneate; petiole indistinct, *c.* 0.5 mm long, or absent. Lamina concave, mostly glabrous but with tiny hairs (0.03–0.05 mm long) near the base and apex, margins glabrous. Upper surface very shiny, venation scarcely evident; lower surface dull, with 6–9 slightly raised parallel veins (measured at base of leaf; 9–13 when measured midway along leaf), midrib not differentiated. Inflorescence borne in upper leaf axils of each branchlet, usually 1-flowered, sometimes 2-flowered. Peduncle 1–1.5 mm long. Fertile bract broadly ovate to orbicular, *c.* 0.8 × 0.7 mm, brown, apex obtuse to subacute, both surfaces glabrous, venation obscure. Bracteoles broadly elliptical, cymbiform, 2.2–2.5 × 1.2–1.3 mm, brown, surfaces glabrous, margin ciliolate, venation obscure, apex apiculate. Sepals lanceolate, 2.8–3.4 mm long, 0.8–0.9 mm wide, slightly longer than corolla tube, pale brown, apex acute to acuminate, glabrous except for tiny hairs in the apical 0.5 mm, margins glabrous, venation obscure. Corolla tube cylindrical, 2.2–2.9 mm long, 0.9–1.4 mm diameter, white, outer surface glabrous, inner surface glabrous on proximal two-thirds, densely hairy on distal one-third. Corolla lobes narrowly deltate, recurved at anthesis, 1.8–2.7 mm long, outer surface glabrous, inner surface densely hairy (obscuring corolla surface) except on apical 0.2–0.4 mm, hairs 0.25–0.4 mm long. Stamens with anthers brown, glabrous, 0.7–0.85 mm long, partially exserted from corolla tube, sterile tips absent, filament attached to upper half of anther; filaments straight, inserted near top of corolla tube. Nectary lobed, *c.* 0.4 mm long. Ovary glabrous, *c.* 0.7 mm long and 0.6 mm diameter, 5-locular. Style straight, glabrous, 2.7–3.6 mm long, slightly exserted from corolla, stigma expanded. Fruits ellipsoidal, 2.5–2.9 mm long, 1.4–1.5 mm diameter, 5-locular, but often only 1 or 2 seeds developing; surface longitudinally striate, glabrous, yellow (*Powell 4669*, *Gittins 878*) when fresh. **Fig. 1A &B, 2A–D**.

***Additional selected specimens examined*: Queensland.** Port Curtis District: Marlborough Station, *c.* 43 km NW of Yaamba, Aug 2006, *Harte s.n.* (BRI [AQ752024]); Princhester Conservation Park, Jan 1996, *Hunter JB873* (BRI); Mt Bonnie Doon, Rockhampton, Jan 1989, *Specht 203 & Reeves* (BRI); 4 km W of Kunwarara, between Canoona and Princhester, track to microwave tower, Jun 2011, *Forster PIF38206* (BRI, NSW); 17.5 miles [28.2 km] NW of Yaamba, Aug 1963, *Speck 1714* (BRI, CANB); Atkinsons Road, Canoona, 25 km from Bruce Highway, Mar 1994, *Bean 7536 & Forster* (AD, BRI); 1 km W of Glen Geddes railway siding, May 1989, *Powell 4668* (BRI, MEL, MO, NSW, NY); 1 km W of Glen Geddes rail siding, May 1992, *Forster PIF9890* (BRI, MEL, NSW); 2 km W of Glen Geddes rail siding, Jan 1992, *Forster PIF9403* (BRI, K, MEL, NSW); Glen Geddes, 2–3 km from Bruce Highway, Apr 2008, *Reeves 3466 & Batianoff* (BRI, E, NSW); 300 m S along Bruce Highway from junction with Raspberry Creek road, N of Yaamba, Feb 2014, *Halford QM1206 & Guymer* (BRI, PE); Site 5+, Glen Geddes, N of Rockhampton, Dec 1998, *Batianoff 9812243 et al.* (BRI, MEL, NSW); Glen Geddes on E side of Bruce Highway, between Shoalwater Bay turnoff and Canoona, Mar 1992, *Champion 590* (BRI); Canoona/Yaamba, Shoalwater bay turnoff, Oct 1991, *Batianoff 911016 & Franks* (AD, BRI, MEL, NSW); Canoona, Aug 1964, *Gittins 878* (BRI); *c.* 2 km SE on back road to Canoona, May 1989, *Powell 4669* (BRI, CANB, MEL, NSW, NY); Canoona, *c.* 30 miles [48 km] NNW of Rockhampton, Sep 1943, *Blake 15323* (BRI); Spinifex Hill, The Caves, Livingstone Shire council quarry, Sep 2001, *Batianoff 010916* (BRI).

***Distribution and habitat*:** *Styphelia cognata* is confined to a limited area north of Rockhampton, between Marlborough and The Caves (**Map 1**). It grows on hilly terrain in open woodland of *Corymbia xanthope* (A.R.Bean & Brooker) K.D.Hill & L.A.S.Johnson and *Eucalyptus fibrosa* F.Muell. subsp. *fibrosa*, on shallow soils derived from serpentinite.

***Phenology*:** Flowers are recorded for every month of the year; fruits are recorded for January, April, May, August, September and December.

***Affinities*:** *Styphelia cognata* is closely allied to *S. cuspidata*, but differs by the leaves 5.4–9 × 1.5–2.1 mm (10–18 × 2–4 mm for *S. cuspidata*), the inflorescences 1(–2)-flowered ((1–)2–4-flowered for *S. cuspidata*), the

corolla tube 2.2–2.8 mm long (1.5–1.9 mm long for *S. cuspidata*), and the style glabrous (style conspicuously hairy in lower half for *S. cuspidata*).

***Conservation status*: Least Concern** (IUCN 2012). The species is known from a minimum of 11 subpopulations, and is known from Princhester Conservation Park.

***Etymology*:** The epithet is from the Latin *cognatus* meaning 'closely related'. This is in reference to its overall similarity to *S. cuspidata*.

Styphelia cuspidata (R.Br.) Spreng., *Syst. Veg., ed. 16 [Sprengel]* 1: 657 (1824); *Leucopogon cuspidatus* R.Br., *Prodr. Fl. Nov. Holland.* 545 (1810). **Type:** [Queensland. Port Curtis District:] Northumberland Islands, 29 September 1802, *R. Brown (Bennett Number 2463)* (lecto: BM 001040149 *i.d.v.* [here designated]; isolecto: BRI [AQ0430205], G 00455453 *i.d.v.*, L 0006521 *i.d.v.*, MEL 1512188 *i.d.v.*, P 00760530 *i.d.v.*, P 00760530 *i.d.v.*).

Leucopogon sp. (Border Island G.N.Batianoff 9009182); Crayn (2018).

Shrub 0.4–1.5 m high. Young branchlets white, grey or brown, with dense hispidulous patent hairs *c.* 0.05 mm long. Older stems glabrescent, with fissured grey to brown bark. Leaves spirally arranged, antrorse, obovate to oblanceolate, the larger ones 10–18 × 2–4 mm, *c.* 0.15 mm thick, apex acuminate (acumen pungent, 0.8–1.5 mm long), base cuneate; petiole indistinct, *c.* 0.5 mm long, or absent. Lamina flat or concave, margins glabrous or with short stiff hairs. Upper surface very shiny, mostly glabrous but with tiny hairs (0.03–0.05 mm long) near the base and apex, venation usually visible; lower surface dull, greenish-white, with 6–9 slightly raised parallel veins (measured at base of leaf; 9–13 measured midway along leaf), midrib not differentiated, glabrous or with tiny hairs (0.03–0.05 mm long) throughout. Inflorescence comprising (1–)2–4 flowers borne in upper leaf axils of each branchlet. Peduncle 0–1 mm long. Fertile bract broadly ovate to orbicular, *c.* 0.6 × 0.5 mm, pale brown, apex acute, both surfaces glabrous, venation obscure. Bracteoles broadly elliptical, cymbiform, 1–1.3 × 1–1.1 mm, brown, surfaces glabrous, margin glabrous, venation obscure, apex apiculate. Sepals lanceolate, 2.3–3.1 mm long, 0.8–0.9 mm wide, slightly longer than corolla tube, pale brown, apex acute, glabrous except for tiny hairs in the apical 0.5 mm, margins entire, venation obscure. Corolla tube campanulate, 1.5–1.9 mm long, 1.1–1.5 mm wide at distal end, white, outer surface glabrous, inner surface glabrous on proximal two-thirds, densely hairy on distal one-third. Corolla lobes narrowly deltate, recurved at anthesis, 1.8–2.2 mm long, outer surface glabrous, inner surface densely hairy (obscuring corolla surface) except on apical 0.2–0.4 mm, hairs 0.3–0.4 mm long. Stamens with anthers brown, glabrous, 0.9–1.1 mm long, partially exserted from corolla tube, sterile tips absent, filament attached near mid-point of anther; filaments straight, inserted near top of corolla tube. Nectary lobed, 0.3–0.4 mm long. Ovary glabrous, *c.* 0.8 mm long and 0.8 mm diameter, 5-locular, with one ovule per loculus. Style straight, densely hairy on proximal half, 1.8–3.1 mm long, slightly exserted from corolla, stigma expanded. Fruits ellipsoidal, 2.8–3.3 mm long, 1.8–2.2 mm diameter, 5-locular, but often only 1 or 2 seeds developing; surface smooth or faintly ribbed, glabrous, yellow (*Powell 4671*) or orange (*Bean 2880*) when fresh. **Fig. 1C & D, 2E–H**.

***Additional selected specimens examined*: Queensland.** North Kennedy District: Cateran Bay, Border Island, Sep 1990, *Batianoff 9009182* (BISH, BRI, LAE); Hook Island, Nov 1985, *Batianoff 3602* (BRI); Gulnare Inlet, Pinnacle Rock, Whitsunday Island, Sep 1990, *Batianoff 900915 & Herzle* (BISH, BRI, LAE, SAR); Roma Peak, *c.* 40 km S of Bowen, Jun 1991, *Bean 3362* (BRI, CANB, NSW). South Kennedy District: Redcliff Island, near Finlaysons Point, Seaforth, Aug 1992, *Batianoff 9208132* (AD, BRI); Cascade Creek area, Cape Hillsborough NP, *c.* 30 km NW of Mackay, May 1991, *Bean 3122* (BRI); road to council park, Cape Hillsborough NP, May 1989, *Powell 4667* (BRI, CANB, HO, NSW). Leichhardt District: "Killarney", Jul 1991, *Thompson 206* (BRI); Sydney Heads, close to top, Jun 1991, *Champion 521* (BRI). Port Curtis District: Shoalwater Bay, Pyri Pyri sector, Aug 1999, *Brushe JB1818 et al.* (BRI); Burwood property, *c.* 30 km SW of St Lawrence, Jan 1998, *Elson s.n.* (BRI [AQ659253]); Mt Wheeler, SE side, Aug 1993, *Forster PIF13794 et al.* (BRI, MEL, NSW); Mt Hedlow, 16 km E of Rockhampton, *Anderson 3440* (BRI, NSW);

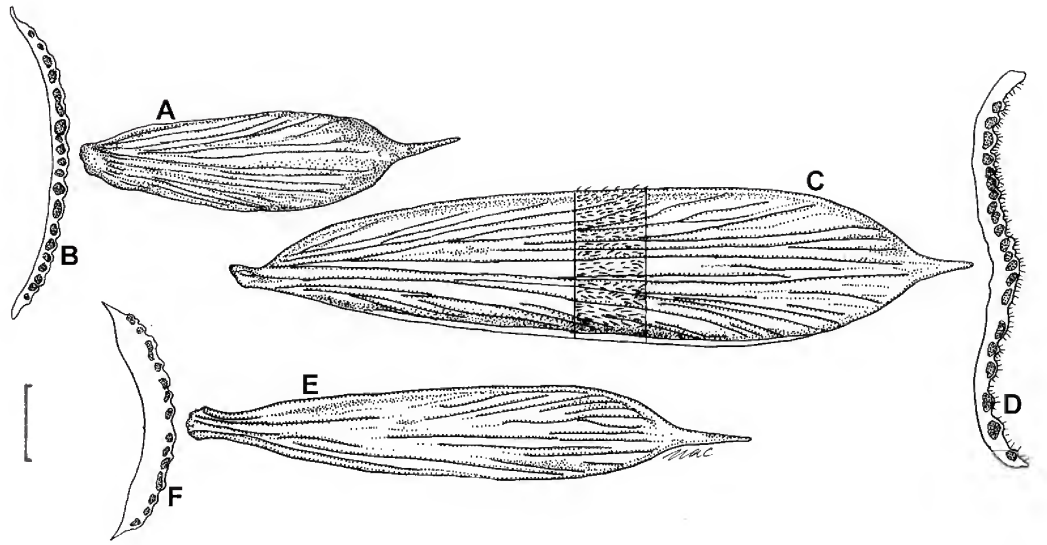

Fig. 1. Leaves of ***Styphelia*** species. ***S. cognata***. A. lower leaf surface. B. cross-section of leaf (upper surface on left). ***S. cuspidata***. C. lower leaf surface. D. cross-section of leaf (upper surface on left). ***S. lucens***. E. lower leaf surface. F. cross-section of leaf (upper surface on left). For A,C,E, scale bar = 1.2 mm; for B,D,F, scale bar = 0.5 mm. A,B from *Champion 590* (BRI); C,D from *Bean 3122* (BRI); E,F from *Batianoff 9403242* (BRI). Scale bar = 10 mm at ×1 magnification. Del. N. Crosswell.

Mt Hedlow, NE of Rockhampton, Apr 1991, *Bean 2880* (BRI); Mt Jim Crow, near Yeppoon, May 1989, *Powell 4671* (BRI, MEL, MO, NSW, NY); upper slopes of Mt Windham, Great Keppel Island, Nov 1987, *Batianoff 9452 & Dillewaard* (BRI); Barren Island, SE of Great Keppel Island, Nov 1987, *Batianoff 9668 & Dillewaard* (BRI, NSW).

Distribution and habitat: *Styphelia cuspidata* is endemic to the central Queensland coast from Hook Island and Roma Peak in the north, to Great Keppel Island and Mt Wheeler in the south (**Map 1**). It inhabits shrublands on hillsides and mountainsides with skeletal soil. The geology is often trachyte.

Phenology: Flowers are recorded for every month of the year; fruits are recorded for March, May, June, July, August and November.

Typification: In 1974, Chew Wee-lek annotated a sheet of *Leucopogon cuspidatus* at BM as the lectotype, but I can find no publication in which the lectotypification was formalised. Therefore, a lectotype is chosen here, and the sheet annotated by Chew is selected.

Bentham (1868: 216) reduced *Acrotriche aristata* Benth. to synonymy with *Leucopogon cuspidatus,* and that synonymy is maintained in the *Australian Plant Census* (APC 2019) and *Plants of the World online* (POWO 2019). There is a single specimen at G (G 00455486) that is reputed to be a type of *Acrotriche aristata* (JSTOR 2019). However, this specimen does not match the protologue very well; both flowers and fruits are well described in the protologue, but neither fruits nor flowers are apparent on the G specimen. G 00455486 is perhaps a syntype of *Lissanthe rigida* Benth., which was named by Bentham in the same publication, and on the same page of the publication. With the exclusion of G 00455486, there is no known authentic specimen of *Acrotriche aristata*. If Bentham did not annotate any specimen with this name, it will be very difficult to confirm authentic material, because the protologue does not list a collector, and the locality given is merely "Australia". *Acrotriche aristata* is unlikely to be synonymous with *Styphelia cuspidata* or its allies because the protologue

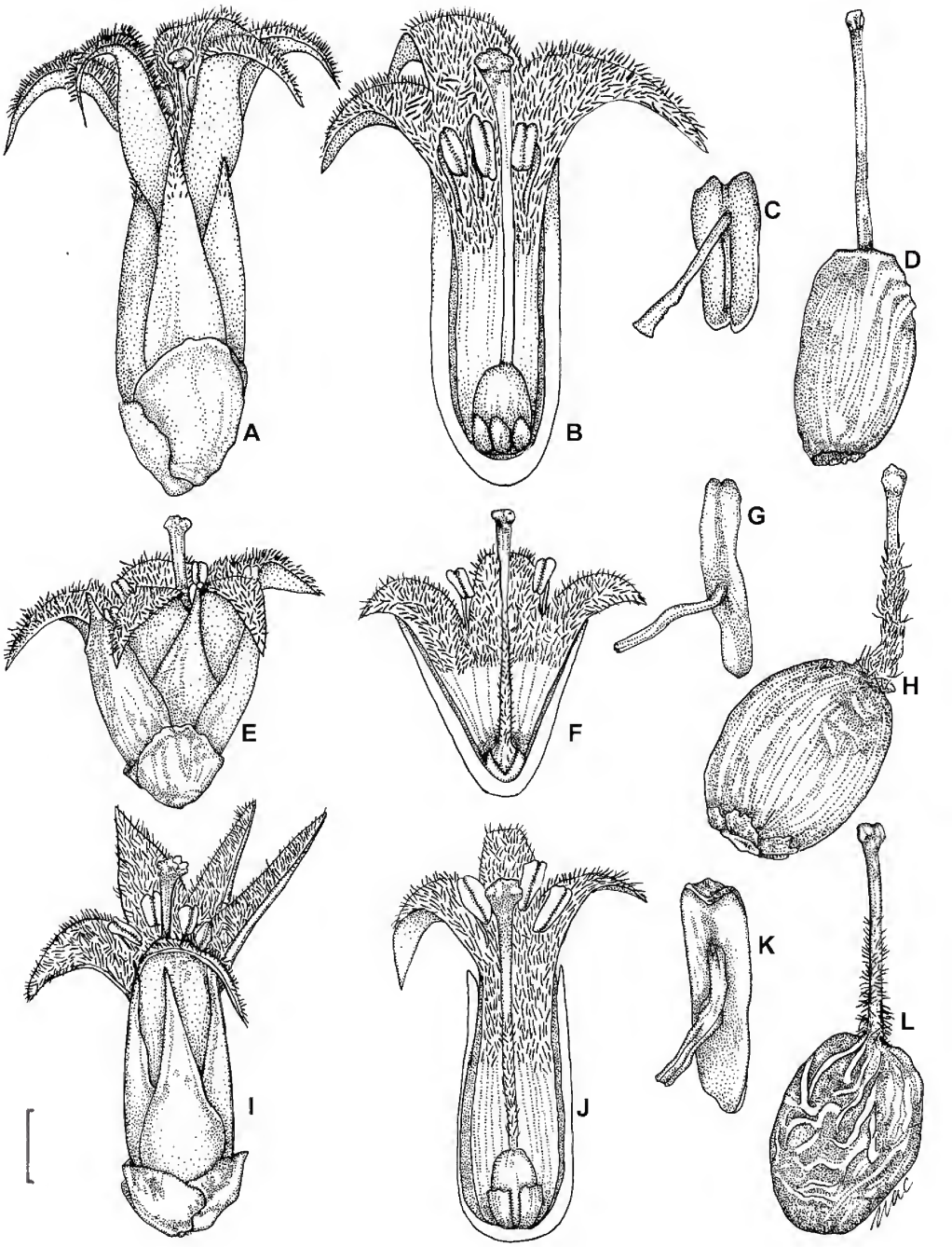

Fig. 2. Flowers and fruits of ***Styphelia*** species. ***S. cognata***. A. lateral view of flower. B. longitudinal section of flower. C. anther showing filament attachment. D. fruit and style. ***S. cuspidata***. E. lateral view of flower. F. longitudinal section of flower. G. anther showing filament attachment. H. fruit and style. ***S. lucens***. I. lateral view of flower. J. longitudinal section of flower. K. anther showing filament attachment. L. fruit and style. For A,B,E,F,I,J scale bar = 0.83 mm; for C,G,K, scale bar = 0.33 mm; for D,H,L, scale bar = 1 mm. A from *Reeves 3466* (BRI); B,C from *Champion 590* (BRI); D from *Gittins 878* (BRI); E–G from *Bean 3122* (BRI); H from *Forster PIF13794* (BRI); I–L from *Batianoff 9403242* (BRI). Scale bar = 10 mm at ×1 magnification. Del. N. Crosswell.

says that the fruits are "oblong", and the branchlets "villous". In *S. cuspidata*, the fruits are ellipsoidal (described by Bentham (1868: 216) as "ovoid"), and the branchlet hairs are hispidulous (described by Bentham (1868: 215) as "minutely pubescent"), while the term 'villous' suggests hairs that are long and shaggy.

***Affinities*:** *Styphelia cuspidata* is morphologically very close to *S. trichostyla*, but *S. cuspidata* differs by the shorter hairs on the branchlets, the shorter leaf acumen, and the shorter style (**Table 1**). The two species are allopatric, with *S. trichostyla* reaching its northern limit at Kroombit Tops, SW of Gladstone. Vegetative specimens of *S. cuspidata* are very similar to a form of *S. mitchellii* (Benth.) F.Muell. that occurs in the Port Curtis District; however, the latter has a corolla tube 5.5–9.5 mm long and a glabrous style 8.5–9.5 mm long.

***Note*:** Brown made his collection of the type of *Styphelia cuspidata* on 29 September 1802, from either Middle Percy Island or nearby Pine Island (Vallance *et al.* 2001). Surprisingly, there are no modern collections of *S. cuspidata* from any of the Percy Islands (AVH 2020).

***Conservation status*: Least Concern** (IUCN 2012). The species is known from several conservation reserves, and is common where it occurs.

Styphelia lucens A.R.Bean **sp. nov.** With affinity to *S. cuspidata* but differing by the somewhat glossy lower leaf surface, the narrower leaves (1.3–1.9 mm wide), the longer anthers (1.3–1.4 mm long), and the much longer corolla lobes (2.5–3.2 mm long). **Typus:** Queensland. North Kennedy District: NE upper slope, Gloucester Island, site 8, 20 April 1994, *G.N. Batianoff 940484 & S. Figg* (holo: BRI; iso: AD, BISH, DNA, L, MEL).

[*Styphelia cuspidata* (R.Br.) Spreng. *pro parte*].

Shrub 0.5–2 m high. Young branchlets white, grey or brown, with dense hispidulous patent hairs 0.02–0.05 mm long. Older stems glabrescent, with fissured grey to brown bark. Leaves spirally arranged, strongly antrorse, oblanceolate, the larger ones 7–12 × 1.3–1.9 mm, *c.* 0.2 mm thick, apex acuminate (acumen pungent, 0.8–1.5 mm long), base cuneate; petiole indistinct, *c.* 0.5 mm long, or absent. Lamina concave, mostly glabrous but with tiny hairs (0.02–0.05 mm long) near the base and apex, margins entire. Upper surface dark green, very shiny, venation scarcely evident; lower surface pale green, somewhat shiny, with 6–9 slightly raised parallel veins (measured at base of leaf; 9–13 measured midway along leaf), midrib not differentiated. Inflorescence comprising 1–2 flowers borne in upper leaf axils of each branchlet. Peduncle 0.5–1 mm long. Fertile bract broadly ovate to orbicular, *c.* 1 × 0.8 mm, brown, apex acute, both surfaces glabrous, venation obscure. Bracteoles broadly elliptical, cymbiform, 1.2–1.6 × 1.1–1.4 mm, brown, surfaces glabrous, margin glabrous, venation obscure, apex acute. Sepals lanceolate, 2.8–3.4 mm long, 0.8–1 mm wide, slightly longer than corolla tube, pale brown, apex acute to acuminate, glabrous except for tiny hairs in the apical 0.5 mm, margins entire, venation obscure. Corolla tube cylindrical, 2–3 mm long, 0.9–1.2 mm diameter, white, outer surface glabrous, inner surface glabrous on proximal half, densely hairy on distal half. Corolla lobes narrowly deltate, recurved at anthesis, 2.5–3.2 mm long, outer surface glabrous, inner surface densely hairy (obscuring corolla surface) except on apical 0.2–0.3 mm, hairs 0.2–0.4 mm long. Stamens with anthers brown, glabrous, 1.3–1.4 mm long, partially exserted from corolla tube, sterile tips absent, filament attached to upper part of anther; filaments straight, inserted near top of corolla tube. Nectary lobed, *c.* 0.5 mm long. Ovary glabrous, *c.* 0.9 mm long and 0.9 mm diameter, 5-locular. Style straight, densely hairy on proximal half, 2.8–3.9 mm long, slightly exserted from corolla, stigma capitate. Fruits ellipsoidal, 2.6–3.4 mm long, 1.6–2 mm diameter, 5-locular, but often only 1 or 2 seeds developing; surface longitudinally striate, glabrous, orange (*Jensen 3952 et al.*; *Bean 4202*) or yellow (*Cumming 22156 & Thompson*) at maturity. **Fig. 1E &F, 2I–L**.

***Additional selected specimens examined*: Queensland.** North Kennedy District: Return Creek track, Taravale, SW of Paluma, May 2009, *Bean 28856 & Jensen* (BRI); 3.3 km S of Taravale Homestead on the Loop Track, Mount Zero–Taravale Wildlife Sanctuary, Jun 2018, *Jensen 3952 et al.* (BRI, CNS); 15 km W of Bluewater, NW of Townsville, Apr 1992, *Bean 4383* (BRI, NSW); Near Mt Cook, Magnetic Island, Aug 1982, *Sandercoe 931* (BRI); Arcadia–Horseshoe Bay, Magnetic Island, Nov 1964, *Jackes s.n.* (BRI [AQ744298]); 1 km NW of Frederick Peak, 25 km SW of Townsville, May 1991, *Bean 3088* (BRI, NSW); Mt Abbot, 50 km W of Bowen, Mar 1992, *Bean 4202* (BRI); *ibid*, Jul 1992, *Bean 4750* (BRI); Mt Bertha, Gloucester Island, Mar 1994, *Batianoff 9403313 et al.* (AD, BISH, BRI); W side of road to Monties Resort [Gloucester Island], Mar 1994, *Batianoff 9403242 & Dillewaard* (AD, BISH, BRI, DNA, MEL); Monties Resort, Cape Gloucester, Mar 1994, *Batianoff 9403243A & Dillewaard* (BRI); Pear Rock hill, Mt Stewart Range, 13 km WNW of Homestead, Mar 2004, *Cumming 22156 & Thompson* (BRI).

***Distribution and habitat*:** *Styphelia lucens* extends from Gloucester Island (E of Bowen) to Taravale (NW of Townsville), mainly close to the coast but with an outlier at Mt Stewart Range, near Pentland (**Map 1**). It grows in shrubland on skeletal soils mainly derived from granite.

***Phenology*:** Flowers have been recorded from March to August, with one record in November. Fruits are recorded from March to July.

***Affinities*:** *Styphelia lucens* is related to *S. cuspidata*, but differs by the pale green, somewhat thicker leaves with a glossy lower surface, the leaves 1.3–1.9 mm wide (2–4 mm wide for *S. cuspidata*), the anthers 1.3–1.4 mm long (0.9–1.1 mm long for *S. cuspidata*), the corolla tube cylindrical (campanulate for *S. cuspidata*), and the corolla lobes 2.5–3.2 mm long (1.5–1.9 mm long for *S. cuspidata*).

***Conservation status*: Least concern** (IUCN 2012). Known from numerous subpopulations with some from National Parks.

***Etymology*:** The epithet is from the Latin *lucens* meaning 'shining'. This is in reference to the glossy leaves in this species.

Table 1. Comparison of *Styphelia cognata, S. cuspidata, S.lucens* and *S. trichostyla*

Species	Style indumentum	Style length	Leaf acumen length	Anther length	Corolla lobe length	Leaf width
Styphelia cognata	glabrous	2.7–3.6 mm	0.8–1.6 mm	0.7–0.85 mm	1.8–2.7 mm	1.5–2.1 mm
Styphelia cuspidata	densely hairy in lower half	1.8–3.1 mm	0.8–1.5 mm	0.9–1.1 mm	1.5–1.9 mm	2–4 mm
Styphelia lucens	densely hairy in lower half	2.8–3.9 mm	0.8–1.5 mm	1.3–1.4 mm	2.5–3.2 mm	1.3–1.9 mm
Styphelia trichostyla	densely hairy in lower half	3.3–4 mm	1.5–2.5 mm	0.8–1 mm	1.7–2.4 mm	1.7–2.7 mm

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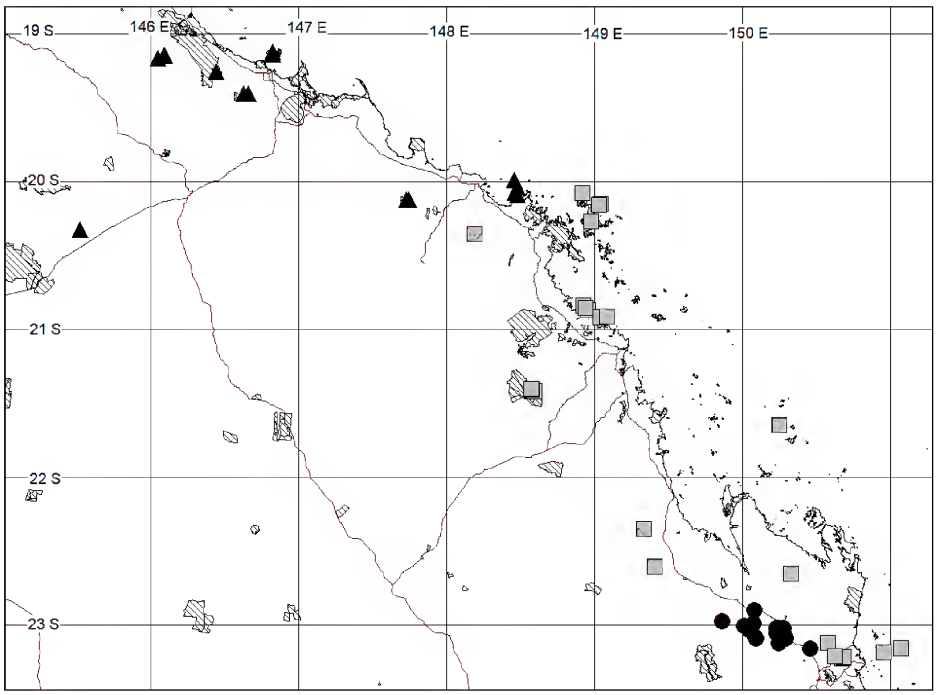

Map 1. Distribution of ***Styphelia cognata*** ●, ***S. cuspidata*** ■, ***S. lucens*** ▲.

Bulbine fraseri Kunth (Asphodelaceae) reinstated and distinguished from *B. bulbosa* (R.Br.) Haw. in eastern Australia

Peter F. Horsfall[1] & David E. Albrecht[2]

Summary

Horsfall, P.F. & Albrecht, D.E. (2020). *Bulbine fraseri* Kunth (Asphodelaceae) reinstated and distinguished from *B. bulbosa* (R.Br.) Haw. in eastern Australia. ***Austrobaileya* 10(4): 612–620**. *Bulbine fraseri* Kunth, a species long placed in synonymy under *B. bulbosa* (R.Br.) Haw. is reinstated for populations occurring on cracking clay plains in parts of Queensland, New South Wales and South Australia. A summary of the morphological features distinguishing the two species is provided, along with a description, illustrations, habitat information and a distribution map for *B. fraseri*.

Key Words: Asphodelaceae; *Bulbine*; *Bulbine fraseri*; *Bulbine bulbosa*; Australia flora; New South Wales flora; Queensland flora; South Australia flora; taxonomy; Eromanga Sea

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Introduction

The genus *Bulbine* Wolf includes approximately 75 species, the majority occurring in sub-Saharan Africa (Byng 2014). Seven species are currently recognised for Australia (CHAH 2019). Watson (1986) divided the Australian species into two informal groups based on longevity and flower size. The perennial "*Bulbine bulbosa* group' was studied in detail utilising cytology, morphology and breeding experiments. This work ultimately led to the recognition of two segregate species, *B. vagans* E.M.Watson and *B. glauca* E.M.Watson. Unlike *B. bulbosa*, these two species, and an additional species *B. crassa* D.I.Morris & Duretto described subsequently, all lack tuber development.

Even with the segregation of these three species from *Bulbine bulbosa*, the latter remains a morphologically and cytologically variable species (Watson 1987). Watson (1986, 1987) drew attention to the morphological distinctness of Queensland (Qld) populations from Hughenden, Blackall and Springsure, and intimated that they may require "taxonomic segregation" based on their ovoid tuber, partly spreading stamens, acute staminal hairs and longer style.

Recent study of specimens of *Bulbine bulbosa* at the Queensland Herbarium (BRI), together with examination of populations in the field have confirmed the morphological distinctiveness of these Qld populations and revealed additional characters that distinguish them from *B. bulbosa s.str.* Examination of specimens at the Australian National Herbarium (CANB), National Herbarium of Victoria (MEL) and the State Herbarium of South Australia (AD) has also revealed that the distribution of this entity occurs beyond Qld, extending into western New South Wales (NSW) and at least north eastern South Australia (SA).

After consideration of nomenclatural issues and examination of type material it was concluded that the name *Bulbine fraseri* Kunth should be applied to these populations. As a detailed description of this species does not exist currently, one is presented below, in addition to information on its distribution and ecology. A summary of the morphological features distinguishing it from *B. bulbosa s.str.* is also provided.

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Materials and methods

This study involved examination of herbarium specimens at BRI and CANB, in addition to dried and spirit specimens in the personal collection of PFH. Images of selected specimens housed at MEL and AD were also examined. Live plants were studied in the field in the Prairie – Muttaburra and Injune areas of Qld, and also in cultivation. All floral measurements are based on fresh, and rehydrated dried specimens. Dimensions are inclusive, i.e. 1.0–1.7 is given as 1–1.7.

Taxonomy

Bulbine fraseri Kunth, *Enum. Pl. [Kunth]* 4: 565 (1843). **Type citation:** "Nova Hollandia (New South Wales) Fraser legit." **Type:** "cultivated at Glasgow, Scotland, from a tuber collected in NSW in 1828 by C. Fraser" (lecto: K [right hand specimen on sheet corresponding to *Bot. Mag.* 57: t. 3017 (1830)], *fide* Watson 1987: 468).

Blephanthera hookeri Raf., *Fl. Tellur.* 2: 59 (1837). **Type citation:** "Hooker bot. m.. 3017." **Type:** "cultivated at Glasgow, Scotland, from a tuber collected in NSW in 1828 by C. Fraser" (lecto: K [right hand specimen on sheet corresponding to *Bot. Mag.* 57: t. 3017 (1830)], *fide* Watson 1987: 468); non *Bulbine hookeri* Kunth, *Enum. Pl. [Kunth]* 4: 566 (1843).

Geophytic perennial herb, glabrous apart from the stamens. *Tuber* erect in young plants, becoming oblique and finally horizontal in older mature plants, globose in young plants, becoming ovoid to semi-conical and finally cylindrical in older mature plants, sometimes branched, to 12 cm long and 3.5 cm diameter but more commonly *c.* 5 cm long and 3 cm diam., commonly 7–10 cm below ground-level. *Roots* fleshy, brittle, to *c.* 30 cm long and 6 mm wide proximally. *Leaves* forming a basal rosette, succulent, becoming flaccid as plants lose moisture, erect and slightly arching when turgid, with a delicate membranous honey-comb-like pith filled with clear mucous sap at least initially, 27–80 cm long, to 1.4 cm wide at the base, attenuate, smooth, canaliculate, green or faintly glaucous, paler at the very base, basal leaf margins membranous and translucent, veins not raised externally. *Inflorescences* erect, 1–4 per rosette, 50–120 cm long, unbranched (but occasionally fasciating), flowering progressively up the inflorescence; *scapes* terete, stout, often faintly glaucous; *bracts* lanceolate to subulate, 5–25 mm long, with translucent margins broadening towards the somewhat saccate base, clasping subtending pedicel towards base, fully obscuring young flower buds at apex of inflorescence; *pedicels* spreading, often upturned distally when fruiting, increasing in length and thickness with age, to 40 mm long in fruit. *Flowers* 24–46 mm diameter; *tepals* 6, in 2 whorls of 3, pale to bright yellow with a green central vein on the abaxial surface, sometimes orange-red at the apex; *outer tepals* elliptic, 10.5–22 mm long, 3.5–8 mm wide, entire; *inner tepals* obovate, 10–21 mm long, 5.5–11 mm wide, with minute irregular teeth. S*tamens* 6, the 3 opposite the outer tepals variously orientated – one spreading, the other two erect, leaning towards another stamen or spreading; the 3 opposite the inner tepals all spreading; *filaments* 4.5–9 mm long, yellow, tapering to the anther, obviously compressed near base, with fine acicular acute yellow hairs at least on the distal half; *filament hairs* obscuring at least the basal half of each anther abaxially and with some hairs emerging from between basal lobes of each anther adaxially, increasing in density and length (to *c.* 3 mm long) toward the filament apex, distributed along the filament margins proximally, encircling the filament distally; *anthers* 3–4.5 mm long, yellow, with a pair of basal lobes one third to one half the anther length, attached at the sinus between the lobes, versatile, initially vertical usually becoming horizontal at dehiscence, shrivelling and gently curved post-dehiscence. *Ovary* 1.5–2.5 mm long, 1.5–2.4 mm diameter, 3–locular, 4 ovules per locule, pale creamy yellow to pale green-yellow; *style* aduncate, 6.5–13 mm long (straightened), ± yellow, usually longer than the staminal filaments and protruding through the staminal ring, narrowing towards the apex; *stigma* entire. *Capsule* irregularly globose to broadly or transversely ellipsoid

and abruptly constricted at the pedicel, 5.5–10 mm high, 4.6–8 mm diameter, light green, thinly fleshed. *Seed* 2.8–4.3 mm long, very dark brown to almost black, dull, 3-angled in transverse section, outer face slightly convex, inner 2 faces flat to slightly convex, sometimes slightly tuberculate on one or more faces; *testa* very finely reticulate. **Figs. 1–5**.

***Selected specimens examined*: Queensland.** Burke District: 13 km E of Hughenden, Flinders Highway, Jul 1985, *Williams 85050* (BRI). South Kennedy District: Mt Coolon Road, 1.3 km E of Power line (14.5 km W of North Goonyella), Mar 1995, *Champion 1187* (BRI); 101 km SW of Mt Coolon, Mar 1995, *Fensham 2689* (BRI); 14 miles [22.5 km] NE of Durdham Downs Station, Aug 1964, *Adams 1248* (BRI, CANB). Gregory North District: 7.5 km S of the Westerton turnoff between Westerton & Warbreccan, Sep 1984, *Chinnock 6079* (AD, BRI, CANB). Mitchell District: S boundary of Edgbaston Reserve, NE of Aramac, Apr 2012, *Bean 31742* (BRI); Isisford district, Feb 1997, *Fensham 3084* (BRI); Kooroorinya Race Track Reserve, *c.* 50 km S of Prairie, Aug 2016, *Horsfall PFH4700* (BRI). Burnett District: E 116, Narayen, Mar 1973, *s. coll.*, (BRI [AQ487548]). Gregory South District: 1.5 km SSW of Hammond Downs Homestead, Apr 1984, *Purdie 2099* (BRI, CANB). Warrego District: Coongoola, *c.* 40 km S of Wyandra, Apr 1936, *Blake 11240* (BRI). Maranoa District: Roma Southern Road, 0.7 km W of Bungeworgorai Creek crossing SSW Roma, Nov 2005, *Eddie CPE987* (BRI). Darling Downs District: Oakey rail line, S side of Oakey – Cutella Road, Nov 2001, *Menkins 83* (BRI). **New South Wales.** North Far Western Plains: Tibooburra Road, 5 km SE from Gorge Loop Road (SE of Sturt NP), Nov 2010, *Purdie 7879* (BRI, CANB, NSW). North Western Plains: 32 km from Brewarrina on the Goodooga Road, May 1982, *Craven 7447 & Whitbread* (CANB); Meadow plains Road, Come-by-Chance, Feb 1995, *Tann s.n.* (CANB). South Western Plains: 48 km S of Ivanhoe, Oct 1963, *Mulham S91* (CANB); Bundyulumblah, W of Wanganella, Feb 1976, *Mulham W840* (CANB, NSW). **South Australia.** Lake Eyre Basin: Coopers Creek, *s.dat.*, *s. coll.* (MEL). North East: Throughout Mulyungarie Station toward Quinyambie, Apr 1989, *Bates 18199* (AD).

***Distribution and habitat*:** *Bulbine fraseri* is widely distributed in Qld south of approximately Hughenden and extends southward into western NSW and north-eastern SA (**Map 1**). Most populations occur within the region formerly inundated by the Eromanga Sea that is characterised by heavily weathered marine sediments dating from the Middle Triassic to late Cretaceous (Wecker 1989).

Bulbine fraseri occurs predominantly in climatic areas classified as hot, persistently dry grasslands (Stern *et al.* 2000). All documented populations occur in grasslands on heavy (red, brown or black cracking clay) soil plains, typically dominated by *Astrebla* spp., *Dichanthium sericeum* (R.Br.) A.Camus, and/or *Iseilema* spp. Scattered trees (e.g., *Eucalyptus coolabah* Blakely & Jacobs, *Acacia harpophylla* F.Muell. ex Benth., *A. pendula* A.Cunn. ex G.Don) and shrubs (*Eremophila* spp., *Capparis* spp., *Acacia* spp.) are sometimes present. Associated herbs include *Atriplex* spp., *Daucus glochidiatus* (Labill.) Fisch., C.A.Mey. & Ave-Lall., *Goodenia* spp., *Sclerolaena* spp., *Sida* spp., *Plantago* spp., *Ptilotus* spp. and *Solanum* spp. The soil type at a collection location in SA (Mulyungarie Station, *Bates 18199*) needs rechecking as it is atypical, being described as a rich red loam.

***Phenology*:** Flowering plants can be found at any time of the year depending on the timing of rains. At Kooroorinya Reserve near Hughenden in Qld, flowering plants were observed approximately five weeks after rain.

***Typification*:** Watson (1987) lectotypified *Bulbine fraseri* Kunth and *Blephanthera hookeri* Raf. on the same specimen at K corresponding to *Bot. Mag.* 57: t. 3017. *Blephanthera hookeri* is the earlier name but it is preoccupied in *Bulbine* by *Bulbine hookeri* Kunth, a name that is currently treated as a synonym of *Bulbine glauca* (Raf.) E.M.Watson (Watson 1987). Thus, the earliest available name is *Bulbine fraseri* Kunth.

Fraser did not accompany Allan Cunningham through what is now known as Cunningham's Gap, west to the Darling Downs on the 1828 expedition from the Moreton Bay penal colony. While he had accompanied Cunningham in the ascent of Mt Barney, he returned to Moreton Bay on 11 August 1828, with Cunningham passing through the newly discovered gap on 25 August 1828 (Feeken 1970). So if the time line provenance of the material that Fraser sent to Kew is correct, then it was perhaps collected by Cunningham

or others present and passed onto Fraser. If this is the case, then the material likely originated from somewhere west of the Main Range near the eastern distribution limit for the species north of Oakey.

Notes*: *Bulbine fraseri differs from *B. bulbosa* for a range of characters outlined in **Table 1**. These include a more elongated horizontal tuber in mature plants, spreading stamens (at least those opposite the inner tepals), longer acute acicular staminal filament hairs that occur along a great length of the filaments, longer and more deeply lobed versatile anthers that are attached well above the base, a longer style and larger seeds. In addition, *B. fraseri* tends to have more widely spreading and often distally upturned fruiting pedicels (typically more ascending in *B. bulbosa*) and the thickened roots connected to the tuber are less strongly tapered than in *B. bulbosa*. These thickened roots may act as an additional storage organ and are possibly the contractile organ that move the plants lower into the substrate. This also appears to be the case for *B. bulbosa* (PFH pers. obs.).

Even with *Bulbine fraseri* segregated from *B. bulbosa*, the latter remains a morphologically variable species, most obviously in the size and stature of plants. Watson's (1986) study also indicates that *B. bulbosa* is a cytologically variable species with 4*x* (24-chromosome), 8*x* (48-chromosome) and 12*x* (72-chromosome) karyotypes known. Many populations of *B. bulbosa s.str.* are less robust than *B. fraseri;*, however, some are of a comparable size. *Bulbine fraseri* can produce very large inflorescences, with over 100 flowers per inflorescence counted at the Strathroy Road population near Hughenden. Inflorescence fasciation has been observed in some *B. fraseri* populations. The effected inflorescences continued to elongate, flower and set seed, and approximately 300 flowers were counted on one fasciated inflorescence.

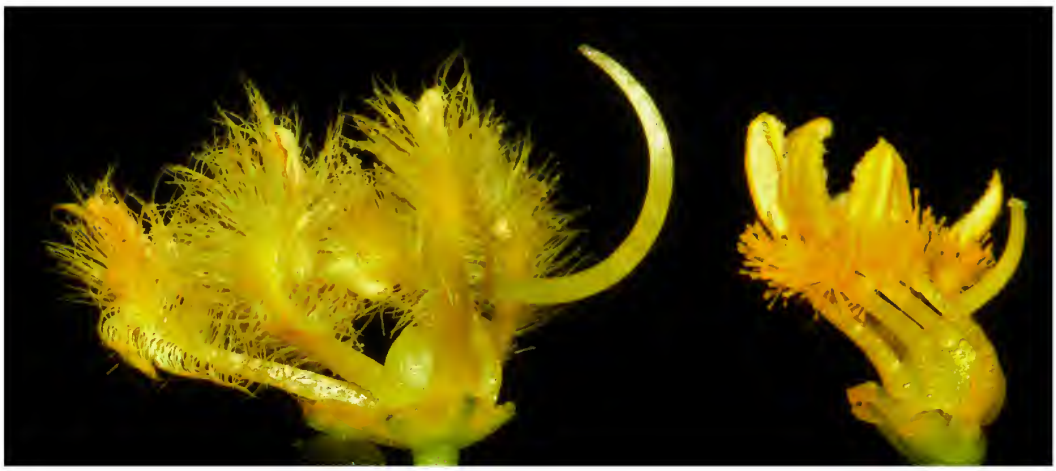

Fig. 1. Flowers of ***Bulbine fraseri*** (*Horsfall PFH4700*, BRI) left and ***B. bulbosa*** (cultivated plant from Chatsworth – Wickliffe Road, 4.5 km N of Chatsworth, Victoria) right, both with the tepals removed. Photo: P.F. Horsfall.

Fig. 2. Typical flower of ***Bulbine fraseri*** showing stamen arrangement (*Horsfall PFH4700*, BRI). Photo: P.F. Horsfall.

Fig. 3. Typical tuber growth sequence (L to R) in ***Bulbine fraseri*** from seedling to maturity of five different plants. Note the typical horizontal orientation starting at the second tuber from the left and the growth rings on the large right-hand tuber, indicating an age of at least eight years (population voucher *Horsfall PFH4700*, BRI). Photo: P.F. Horsfall.

Fig. 4. Variation in tuber growth of ***Bulbine fraseri***, showing from L to R: a single tuber with four individual shoots, a conglomerate of small tubers, tuber dividing in the same manner as *B. bulbosa*, cylindrical tuber dividing three ways (population voucher *Horsfall PFH4700*, BRI). Note that none of the tubers were growing vertically when removed from the ground. Photo: P.F. Horsfall.

Fig. 5. Population of ***Bulbine fraseri*** at Kooroorinya Reserve, Qld showing habit and habitat (population voucher *Horsfall PFH4700*, BRI). Photo: P.F. Horsfall.

Bulbine fraseri appears to be more habitat-specific than *B. bulbosa*, with records indicating a close association with grasslands on cracking clay plains. *Bulbine bulbosa* on the other hand occurs on a range of soil types (including sandy loam, clay loam and lithosols), and in various landscape positions (e.g., plains, hillslopes, mountains, creeks, swamps) and structural vegetation types (e.g., woodlands, forests, herbfields, grasslands). On a continental scale occurrences of *B. fraseri* are generally further west and/or north than those of *B. bulbosa*. In contrast, *B. bulbosa s.str.* occurs in south-eastern SA, Victoria, Tasmania, eastern NSW and just extends into the very south-eastern edge of Qld (e.g., Stanthorpe, CANB 107739).

Bulbine fraseri exhibits considerable variation in tuber size and shape, which to a considerable degree is age-related (**Fig. 3**). Tubers vary from occasionally ovoid to more commonly semi-conical and cylindrical. Long tubers have slight depressions along their length indicating seasonal growth. As the oldest growth wanes the tuber reduces, then withers and rots off. Other less commonly observed tuber variation is illustrated in **Fig. 4**.

Hoverflies were commonly observed working the flowers of *Bulbine fraseri* at the Strathroy Road (SSE of Hughenden, Qld) and Injune (Qld) field sites. Small native bees were also observed working *B. fraseri* flowers at Injune.

Populations of *Bulbine bulbosa s.lat.* from Hughenden, Blackall and Springsure that were included in Watson's (1986) study are all referable to *B. fraseri*. Watson placed these three populations in the *B. bulbosa s.lat.* 8*x* (48-chromosome) karyotype group along with populations of *B. bulbosa* (*s.str.*) from NSW, ACT, Victoria and SA. She also commented on the tendency for some inhomogeneity in the sets of four chromosomes of the Qld populations, indicating that structural change is taking place.

***Conservation status*: Least Concern** (IUCN 2012). *Bulbine fraseri* can be locally abundant and has been observed at Kooroorinya Reserve (SSE of Hughenden, Qld) in their many thousands (**Fig. 5**). Even on grazed land plants can be abundant, exemplified by the population along Strathroy Road, where plants in August 2016 were so thick that it was like looking across a field of Canola mixed with Mitchell grass and annual forbs.

Acknowledgements

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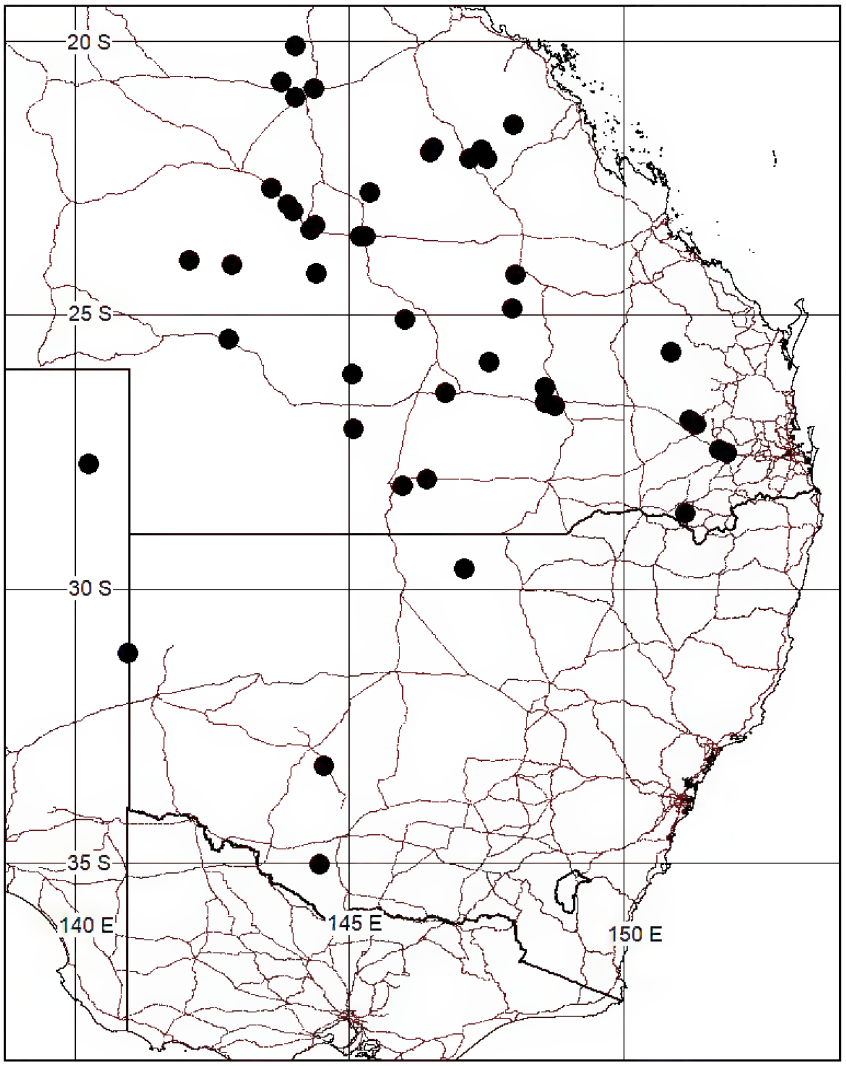
Table 1. Morphological comparison of ***Bulbine fraseri*** and ***B.bulbosa***

Character	*Bulbine fraseri*	*Bulbine bulbosa*
Tuber	Becoming oblique and finally horizontal in older mature plants, ovoid to semi-conical and finally cylindrical in older mature plants, sometimes branched, commonly 5 cm long	Erect, globose to depressed ovoid, to *c.* 2 cm long
Leaves	Glabrous	Glabrous or sparsely papillose to scabrous, particularly on margins
Outer tepals	10.5–22 mm long × 3.5–8 mm wide	10–20 mm long × 3–5 mm wide
Inner tepals	10–21 mm long × 5.5–11 mm wide	9–18 mm long × 4–9 mm wide
Stamen orientation	The 3 opposite the inner tepals all spreading, the 3 opposite the outer tepals variously orientated	All stamens erect with anthers bunched
Filament hairs	Acicular, acute, the longer hairs 2–3 mm long, distributed along at least the distal half of each filament and sometimes extending to within 1 mm filament base	Weakly clavate, obtuse, < 2 mm long , clustered below anthers, rarely with a few very reduced hairs below to midpoint of filament
Anthers	3–4.5 mm long, with a pair of basal lobes 1/3 to ½ anther length, filament inserted at least 1 mm from anther base, versatile, initially vertical usually becomes horizontal at dehiscence, shrivelling and gently curved post-dehiscence	2–3(–3.5) mm long, with a pair of short basal lobes to *c.* ¼ anther length, filament inserted with *c.* 0.5 mm of anther base, not versatile, mostly erect, straight to weakly curved and maintain their shape post-dehiscence but sometimes slightly twisted about vertical axis
Style (straightened)	6.5–13 mm long	3–5.5 mm long
Seed	2.8–4.3 mm long	1.4–3 mm long



Map 1. Distribution of ***Bulbine fraseri*** in Australia based on herbarium specimens housed at AD, BRI, CANB and MEL. Map courtesy of A.R. Bean (BRI).

Zieria abscondita P.I.Forst. (Rutaceae), a new and restricted species from south-east Queensland

Paul I. Forster

Summary

Forster, P.I. (2020). *Zieria abscondita* P.I.Forst. (Rutaceae), a new and restricted species from south-east Queensland. ***Austrobaileya* 10(4): 621–627**. The new species *Zieria abscondita* is described and compared to *Z. furfuracea* R.Br. ex Benth. *Zieria abscondita* is restricted to rhyolite substrates at a single location and differs in the foliage gland and indumentum composition and cover, flower colour and size from *Z. furfuracea*. The new species is illustrated with line drawings and habitat photographs. *Zieria abscondita* is considered to be Critically Endangered based on its single location and very restricted extent of occurrence and area of occupancy. New combinations are *Zieria euthadenia* (J.A.Armstr.) P.I.Forst. comb. & stat. nov. and *Z. gymnocarpa* (J.A.Armstr.) P.I.Forst. comb. & stat. nov., both based on taxa previously included as subspecies of *Z. furfuracea*. Revisions to the identification key for Queensland *Zieria* are provided to accommodate the three additional species.

Key Words: Rutaceae; *Zieria*; *Zieria abscondita*; *Zieria euthadenia*; *Zieria furfuracea*; *Zieria gymnocarpa*; Australia flora; Queensland flora; new species; taxonomy; identification key; conservation status; critically endangered

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Introduction

The genus *Zieria* Sm. currently comprises 62 species of which 61 are endemic to Australia and one to New Caledonia (George *et al.* 2013; Barrett *et al.* 2014, 2018; Duretto 2019). Taxonomy of the numerous species complexes has not been easy to resolve with many widespread species being highly variable as reflected in the genetic sequence data that has been analysed so far. The species have been defined from a morphological perspective, by sorting of character states based on differences in glandular and indumentum development on both the foliage and reproductive structures, as well as floral, fruit and seed characters.

Hypotheses on speciation in *Zieria* have been previously presented (Duretto & Forster 2007), with the concept from a genetic perspective of incomplete lineage sorting being proposed by Barrett *et al.* (2018) as an explanation in part for the complex radiation and incongruence that has occurred.

Thirty-seven species of *Zieria* have been previously recognised for Queensland (Duretto & Forster 2007; George *et al.* 2013; Duretto 2019). In the current paper a further species is added that was discovered during fieldwork in 2017, and two subspecies are raised to species rank, thus bringing the total to forty.

Materials and methods

The results and conclusions in this paper are based on study of specimen collections at the Queensland Herbarium (BRI) and habitat fieldwork for all three species. Measurements in descriptions are inclusive, i.e. 1.0–1.7 is given as 1–1.7.

Taxonomy

Zieria abscondita P.I.Forst. **sp. nov.** Similar to *Zieria furfuracea* but differing in the leaflets with obvious venation below due to less indumentum, the inflorescences with fewer flowers and the smaller flowers that have corolla lobes lacking an inflexed mucro.

Accepted for publication 23 January 2020

Typus: Queensland. Moreton District: Bloodwood Creek Nature Refuge, Crossdale, 6 December 2017, *P.I. Forster PIF45381 & G. Leiper* (holo: BRI [2 sheets]; iso: CNS, MEL, NSW, US).

Shrub to 2 m tall, forming an open straggly bush. Stems erect, wiry; branches without decumbent leaf bases, sparsely glandular verrucose, densely tomentose with an indumentum admixture of stellate and simple trichomes that are persistent on the leafy stems. Leaves palmately trifoliate; petioles 5–12 mm long, 0.4–0.5 mm diameter, sparsely (though very noticeably) glandular verrucose and densely tomentose with an indumentum admixture of stellate and simple trichomes, pale green; terminal leaflets narrowly elliptic, 13–36 mm long, 4–7 mm wide, lateral leaflets similar to terminal leaflets but smaller, leaflet length/width ratio: 3.3–7.3, adaxially with venation largely obscure, sparsely glandular verrucose and with scattered indumentum of bifid, simple and stellate trichomes, matt mid green, abaxially with 8–10 lateral (secondary) veins obvious and some interlateral (tertiary) veins visible, sparsely glandular verrucose and with dense indumentum of simple and stellate trichomes, silver-green, tip acute to obtuse, margins entire and somewhat sinuate, recurved becoming strongly revolute when drought stressed. Inflorescence axillary, shorter than the subtending leaf, 3–12+flowered, sparsely glandular verrucose and with a sparse indumentum of simple and stellate trichomes with the latter mainly restricted to the glands; peduncle 4–14 mm long, bracts linear, 0.6–0.8 mm long, *c.* 0.1 mm wide, caducous, secondary peduncles 1–5 mm long. Flower pedicels 1.2–2 mm long, not glandular verrucose, with sparse indumentum of simple and stellate trichomes; sepals ovate-triangular, weakly imbricate in bud, 0.7–1 mm long, 0.7–0.8 mm wide, tip acute, adaxially weakly but obviously glandular verrucose and with scattered indumentum of simple and stellate trichomes, abaxially with dense indumentum of simple and stellate trichomes, the latter particularly near the margins; petals elliptic, valvate, 1.8–2.2 mm long. 0.7–1.3 mm wide, white to somewhat cream on drying, tips acute and not with an inflexed mucro, not obviously glandular verrucose, both adaxially and abaxially with dense indumentum of stellate trichomes; staminal filaments dilated basally, 1–1.2 mm long, glabrous, eglandular; anthers *c.* 0.5 mm long, apiculum absent; gynoecium glabrous. Fruit cocci 2.6–3 mm long, 1.7–1.8 mm wide, weakly glandular verrucose, glabrous. Seeds not seen. **Figs. 1 & 2**.

***Additional specimens examined*: Queensland.** Moreton District: Bloodwood Creek Nature Refuge, Crossdale, Sep 2017, *Forster PIF45321 et al.* (BRI); *ibid*, Sep 2017, *Forster PIF45334 et al.* (BRI, MEL).

***Distribution and habitat*:** *Zieria abscondita* is known from a single location at Crossdale (**Fig. 3**) where it occurs more or less continuously for at least 500 m in a thin linear strip along an incised waterway carved through rocky terrain derived from a large rhyolitic intrusion (Leven 1977). The vegetation comprises a low woodland dominated by an overstorey of *Eucalyptus dura* L.A.S.Johnson & K.D.Hill and *Lophostemon confertus* (R.Br.) Peter G.Wilson & J.T.Waterh. with a midstorey and understorey thicket of *Bertya opponens* (F.Muell. ex Benth.) Guymer, *Grevillea banksii* R.Br., *Eucalyptus exserta* F.Muell., *Kunzea flavescens* C.T.White & W.D.Francis and *Z. abscondita*, as well as numerous vinethicket elements.

***Notes*:** Relationships for *Zieria abscondita* can be sought with *Z. furfuracea* R.Br. ex Benth. as the two species share many similarities. The molecular sequence work of Barrett *et al.* (2018) indicated that the current taxonomy of *Z. furfuracea* with three subspecies was not monophyletic with the inference that the subspecies are worthy of specific rank which is formally undertaken below. That observation has also influenced the decision to describe this taxon at specific rank rather than adding it as a further subspecies of *Z. furfuracea*. There are no known intermediate populations between *Z. abscondita* and the three previously recognised subspecies of *Z. furfuracea* with all taxa being very disjunct

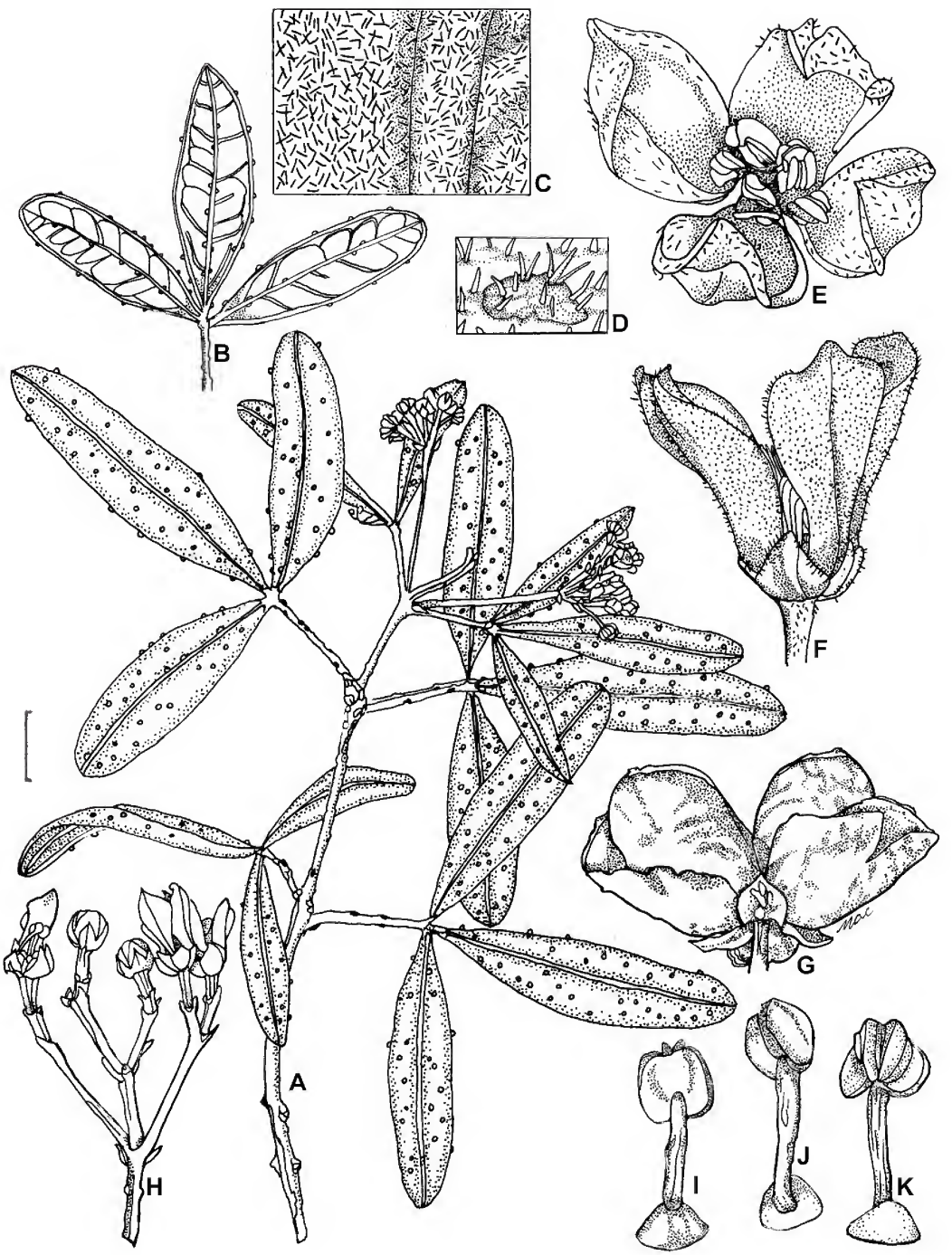

Fig. 1. ***Zieria abscondita***. A. habit of flowering branchlet ×1.5. B. abaxial view of leaf showing venation ×2. C. indumentum cover on abaxial leaf surface ×30. D. inflorescence with flowers ×4. E. side view of flower ×10. F. face view of flower ×18. G, H, I. revolving views of the stamen showing the basal dilation ×20. J. fruit comprising two dehisced cocci ×10. A–D, J from *Forster PIF45334 et al.* (BRI); E–I from *Forster PIF45381 & Leiper* (BRI). Scale bar = 10 mm ×1 magnification. Del. N. Crosswell.

Fig. 2. ***Zieria abscondita***. Flowering branchlet (*Forster PIF45381 & Leiper*, BRI). Photo: G. Leiper.

Fig. 3. Habitat of ***Zieria abscondita*** (*Forster PIF45381 & Leiper*, BRI). Photo: G. Leiper.

from one another with populations of *Z. euthadenia* (J.A.Armstr.) P.I.Forst. *c.* 60 km northeast and *Z. gymnocarpa* (J.A.Armstr.) P.I.Forst. *c.* 70 km east-southeast distant. Both *Z. euthadenia* and *Z. gymnocarpa* occur near the coast in much higher rainfall areas with the former on substrates derived from metamorphics and sandstones, and the latter on sandstones. *Zieria furfuracea s.str.* is endemic to north-east New South Wales at least 260 km to the south.

That aside, *Zieria abscondita* differs from *Z. furfuracea s.l.* in the abaxial leaflet venation being evident (this is mainly due to the sparser and considerably shorter indumentum cover), the few flowered inflorescences (3–12 versus 20–125) and the smaller flowers (corolla petals 1.8–2.2 mm long and lacking an inflexed apical mucro, versus 2.3–3.5 mm long and with an inflexed apical mucro (Armstrong 2002)). It is not noticeably aromatic presumably due to the reduced development of the foliar glands and their much smaller size (although still visible to the naked eye, **Fig. 2**), and is much less velvety hairy, whereas all the previously recognised subspecies of *Zieria furfuracea* are noticeably aromatic and velvety hairy. The fruit of *Zieria abscondita* are glabrous, whereas both *Z. furfuracea* and *Z. euthadenia* are very hairy and both have valvate corollas. In comparison *Z. gymnocarpa* has glabrous fruit and an imbricate corolla. It should be noted most of these characters are relatively minor in the overall scheme of classification and reinforces my earlier comment that the species are examples of 'non-adaptive radiation' accompanied by a 'high lineage diversification rate' (Duretto & Forster 2007). In simpler terms this means that the taxa under discussion are defined by combinations of variations in foliage, size, gland development and indumentum cover and mixture, rather than markedly striking morphological differences.

Zieria abscondita is also somewhat similar to *Z. cytisoides* in terms of its general appearance and shares with that species the distinctively raised lateral venation in the abaxial surface of the leaflets. The two species differ most noticeably in the glandular verrucose foliage (versus not) and the small cream flowers of *Z. abscondita* (versus large pink flowers with sepals 2.5–3 mm long, and a corolla with petals 3.6–6 mm long).

The characters of *Zieria abscondita* will confound the key to Queensland *Zieria* species (Duretto & Forster 2007) at couplet 6 for *Z. graniticola* and *Z. inexpectata*. *Z. abscondita* will key if that couplet is replaced with the following.

6 Terminal leaflets to 7 mm long . . . . . **Z. inexpectata**
6. Terminal leaflets greater than 7 mm long. **6a**

6a Leaf petioles 5–12 mm long; terminal leaflets 4–7 mm wide; petals 1.8–2.2 × 0.7–1.3 mm, white to somewhat cream . . . . . **Z. abscondita**
6a. Leaf petioles 1–3 mm long; terminal leaflets 1.5–4 mm wide; petals (2.5–)3.5–4.5 × 2–2.5 mm, pale pink . . . . . **Z. graniticola**

***Conservation status*:** *Zieria abscondita* is known from a single location where it is locally abundant and wholly within the Bloodwood Creek Nature Refuge. The total extent of occurrence is less than 1 km^2 and the area of occupancy is much less. The population appeared in good condition in 2017 with many seedlings evident. At least several hundred adult plants were observed.

While there are no obvious threats, using the IUCN (2012) criteria, the species can be assessed as being **Critically Endangered** under **B1a, c(ii,iv), 2a, c(ii,iv)** and **C2(a)(ii)**. Ongoing threatening processes at the location include intermittent drought and wildfires, both likely to be exacerbated under climate change projections of a hotter and drier climate

with increasing severe fire weather (Dowdy *et al.* 2015; Hoffman *et al.* 2019). The *Zieria* is restricted to a very narrow band of vegetation along the creek bank and is not found upslope or on the surrounding hillsides; presumably there is some moisture dependency along the creek line. The habitat periodically burns although is actively managed for fires. Under extreme to catastrophic fire conditions, the *Zieria* habitat is likely to be completely burnt and any regeneration would be from a soil seed bank if the species is not a resprouter.

The location has one other listed threatened plant present, namely *Plectranthus leiperi* P.I.Forst. (Vulnerable), although it does not co-occur with the *Zieria*.

***Etymology*:** The specific epithet is from the Latin *absconditum* (hidden, concealed) and alludes both to the occurrence of this species in a rocky gorge and to its late discovery subsequent to many published works on the genus.

New combinations

1. Zieria euthadenia (J.A.Armstr.) P.I.Forst., **comb. et stat. nov.**; *Zieria furfuracea* subsp. *euthadenia* J.A.Armstr., *Austral. Syst. Bot.* 15: 362 (2002). **Type:** Queensland. Moreton District: Kin Kin, January 1917, *C.T. White s.n.* (holo: BRI [AQ318532]).

Zieria furfuracea subsp. (Kin Kin V.K. Moriarty 134); Forster (2002: 181).

2. Zieria gymnocarpa (J.A.Armstr.) P.I.Forst., **comb. et stat. nov.**; *Zieria furfuracea* subsp. *gymnocarpa* J.A.Armstr., *Austral. Syst. Bot.* 15: 363 (2002). **Type:** Queensland. Moreton District: Belmont, 10 September 1887, *J.H. Simmonds s.n.* (holo: BRI [AQ318534]).

Zieria furfuracea subsp. (Belmont Scrub Unknown AQ152898); Forster (2002: 181).

The key to the Queensland species of *Zieria* (Duretto & Forster 2007: 476) may be amended at couplet 3 to accommodate these two species, *viz.*

3 Abaxial surface of leaves stellate tomentose; fruit glabrous or hirsute **3b**
3. Abaxial surface of leaves glabrous to hirsute but not stellate tomentose; fruit glabrous **4**

3b Leaf lamina margin entire or somewhat sinuate with poorly developed marginal glands; petals valvate in bud . . . . . **Z. euthadenia**
3b. Leaf lamina margin crenate with well developed marginal glands; petals imbricate in bud . . . . . **Z. gymnocarpa**

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Clarification of species boundaries within the *Ptilotus royceanus* Benl (Amaranthaceae) group

Timothy A. Hammer[1], Robert W. Davis[2] & Kevin R. Thiele[1]

Summary

Hammer, T.A., Davis, R.W. & Thiele, K.R. (2020). Clarification of species boundaries within the *Ptilotus royceanus* Benl (Amaranthaceae) group. ***Austrobaileya* 10(4): 628–638**. The *Ptilotus royceanus* Benl species group comprises *P. royceanus*, *P. mollis* Benl and *P. maconochiei* Benl. *Ptilotus royceanus* as currently circumscribed has a disjunct distribution, occurring on the border of Western Australia and the Northern Territory and in central Queensland to the east of the range of *P. maconochiei*. *Ptilotus mollis* is endemic in Western Australia. We critically re-examine the morphological boundaries of these species and provide evidence that all Queensland collections currently included in *P. royceanus* are referable to *P. maconochiei*. Updated descriptions and a key are given for all three species.

Key Words: Amaranthaceae; *Ptilotus maconochiei*; *Ptilotus mollis*; *Ptilotus royceanus*; taxonomy; identification key; conservation priority species

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Introduction

Ptilotus (Amaranthaceae) is an Australian genus with *c.* 120 species and a centre of diversity in Western Australia (Hammer *et al.* 2018). A recent molecular phylogenetic study (Hammer *et al.* 2019) has resolved several informally named clades within the genus. The species *P. royceanus* Benl, *P. mollis* Benl and *P. maconochiei* Benl are recovered as a monophyletic clade with high support, informally referred to here as the *P. royceanus* species group ('clade C' in Hammer *et al.* (2019)).

Benl (1970) described *Ptilotus royceanus* and *P. mollis* based on material from Western Australia. *Ptilotus royceanus* was considered by Benl to be morphologically distinctive, being a 'hanging', cremnophilous subshrub with dense indumentum obscuring the vegetative surface, orbicular leaves, and very elongated and interrupted spikes. Benl considered it endemic to the ranges near the border of the Northern Territory and Western Australia (**Figs. 1 & 2**). He differentiated *P. mollis* from *P. royceanus* based primarily on the inflorescences of *P. mollis* being compact and forming a densely crowded spike (**Figs. 3 & 4**). Benl cautioned against assuming a close relationship between the two species, considering the differences in the inflorescences to be significant, though he was unable to make a complete comparison as only a fragmentary specimen of *P. mollis* was available to him (Benl 1970: 6). He regarded that the habit and habitat of *P. mollis* differed from that of *P. royceanus*, being a bushy subshrub growing upright between boulders near creeks. The only known collection at the time was from Warralong Station, Western Australia.

In a subsequent publication, Benl (1979) described *P. maconochiei* based on specimens from Mount Isa, Queensland, commenting that it differed from *P. royceanus* in being a rounded, non-cremnophilous shrub with compact inflorescences (**Figs. 5 & 6**), and from *P. mollis* in having a densely tomentose rather than silky, silvery-grey leaf indumentum.

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Bean (2008) included *P. royceanus* and *P. maconochiei* in a treatment of *Ptilotus* in eastern Australia. Specimens included by Bean as *P. royceanus* from Queensland were described as having compact inflorescences and occurring on rocky slopes, rather than having the characteristic interrupted inflorescences and cremnophilous habitat of that species as given by Benl (1970, 1979). He regarded that the two species in Queensland differed in inflorescence shape, with *P. maconochiei* having globose to ellipsoidal inflorescences while those of *P. royceanus* were narrowly cylindrical.

In the present study, taxonomic boundaries within the *P. royceanus* species group are critically re-evaluated and the morphological segregation of species within the group clarified. Updated descriptions and a key are given for all three species.

Materials and methods

Dried specimens of *Ptilotus maconochiei*, *P. mollis* and *P. royceanus* housed at BRI, MEL and PERTH were examined, covering the geographic range of all three species. Specimens were critically evaluated irrespective of current determinations and compared to the protologues and type specimens, the latter accessed as high-resolution digital images through *JSTOR Global Plants* (https://plants.jstor.org/). Types were examined by the authors unless indicated that an image only was seen by *i.d.v.* (*imago digitalis visa*). Distribution maps were produced using georeferenced records retrieved from the Australasian Virtual Herbarium (https://avh.chah.org.au/). Dimensions in descriptions are inclusive (e.g. 1.0–1.7 is given as 1–1.7).

Common abbreviations in the specimen citations are Mt (Mountain/Mount) and NP (National Park).

Results and discussion

Critical examination of all available specimens from throughout the ranges of the species in the *Ptilotus royceanus* group revealed that all three species are clearly separable based on morphological differences.

Ptilotus mollis is the most distinctive species within the group, being morphologically divergent from the other two. As Benl (1970) pointed out, the indumentum covering the stems and leaves of *P. mollis* consists of long, silky, silvery grey hairs, noticeably different from the white, thickly tomentose indumentum of the other two species. *Ptilotus mollis* can also be segregated from *P. maconochiei* and *P. royceanus* in having sepals that are 1.8–3 mm long and a style that is 0.5–0.7 mm long, the latter species having longer sepals and style (see below).

Ptilotus maconochiei can be readily segregated from Western Australian and Northern Territory populations of *P. royceanus* (referred to here as 'western *P. royceanus*') on the basis of habitat, leaf shape, inflorescence shape, staminal cup length and style length.

The habitat of western *P. royceanus* is quite different from *P. maconochiei*, and appears to be unique within the genus. Plants grow in the narrow fissures of red sandstone cliff faces (**Fig. 2**), making it quite narrowly distributed in the Petermann Ranges on the border of Western Australia and the Northern Territory (**Map 1**). By contrast, *P. maconochiei* grows on rocky slopes or mesas with laterite, shale or quartzite (**Fig. 5**).

Leaves of *Ptilotus maconochiei* are somewhat variable, ranging from broadly ovate to obovate or conspicuously fabellate (fan-shaped) on the same individual. Leaves on western specimens of *P. royceanus* are never fabellate, instead being orbicular to broadly ovate. Leaves of western *P. royceanus* are noticeably shorter than *P. maconochiei*, which are more variable in length based on the shape of the leaf (e.g. sometimes being wider than long).

Ptilotus maconochiei consistently has flowers in tightly compact inflorescences, while inflorescences in western *P. royceanus* are conspicuously interrupted, the stems with terminal inflorescences often being pendulous on plants that hang from rock walls of gorges. Some specimens of western *P.*

Fig. 1. Inflorescence of ***Ptilotus royceanus*** (*Jobson 10779 & Davis*, NT). Photo: T.A. Hammer.

Fig. 2. Habit of ***Ptilotus royceanus*** (*Jobson 10779 & Davis*, NT). Photo: T.A. Hammer.

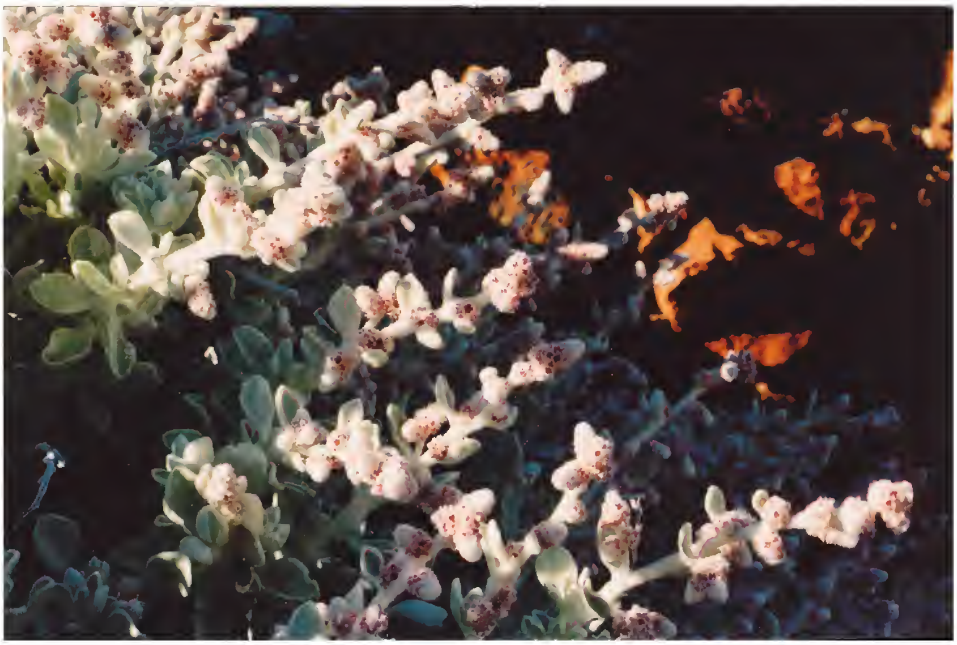

Fig. 3. Inflorescences of ***Ptilotus mollis*** (*van Leeuwen 4845*, PERTH). Photo: R.W. Davis.

Fig. 4. Habit of ***Ptilotus mollis*** (*van Leeuwen 4845*, PERTH). Photo: R.W. Davis.

Fig. 5. Inflorescence of ***Ptilotus maconochiei*** (*Purdie 8598*, CANB). Photo: M. Fagg (Australian Plant Image Index: dig 25946).

royceanus rarely have flowers that are loosely compact (especially towards the apex) and not as elongated and pendulous as is usual, but are none the less distinct from those in Queensland in that the rachis is clearly visible between the flowers.

In the protologue for *Ptilotus maconochiei*, Benl (1979) incorrectly gave the staminal cup length as 3.5–4.5 mm long. This is clearly an error, as it would make the staminal cup nearly as long as the sepals, and does not match the isotype that we examined (PERTH 01558218). All specimens of *P. maconochiei* available to us consistently had staminal cups 0.6–0.8 mm long. Staminal cups in western *P. royceanus* were consistently shorter (0.2–0.4 mm long). The style also differed significantly between *P. maconochiei* and western *P. royceanus*, the former being 1.6–2 mm long and the latter 1–1.4 mm long.

All specimens determined as *Ptilotus royceanus* from Queensland fell within the morphological range of *P. maconochiei*, and were clearly different from western (i.e. true) *P. royceanus*. They occur in similar habitats to *P. maconochiei*, had a similar range of leaf shapes, dense inflorescences with the rachis not visible between the flowers, staminal cups 0.6–0.8 mm long and styles 1.6–2 mm long.

Bean (2008) gave sepal length (as 'tepal' length) as a character discriminating *Ptilotus maconochiei* from the Queensland specimens of *P. royceanus* he examined, indicating that the sepals of *P. maconochiei* were 5–7 mm long and those of Queensland *P. royceanus* were 4–5 mm long. In the protologues, Benl (1970, 1979) gave the sepal length of *P. maconochiei* as 4.5–5 mm long and of *P. royceanus* as 5–6 mm long. Our examinations showed that sepal lengths in all specimens from Queensland, regardless of species determination, overlapped significantly and had a range of 4–6 mm long. *Ptilotus royceanus* from Western Australia and the Northern Territory had a range of 4.5–5.8 mm long. Given the clear overlap in measurements amongst all specimens, we do not regard sepal length as a good character for the use of discriminating these two species.

Bean (2008) also used inflorescence shape in his key separating *Ptilotus maconochiei* and *P. royceanus*, describing inflorescences in *P. maconochiei* as globose to ellipsoidal compared with narrowly cylindrical shape for Queensland *P. royceanus*. Inflorescence shape in these species is a factor of inflorescence length, shorter inflorescences appearing more globose and longer ones more cylindrical. Inflorescences in *Ptilotus* are indeterminate, their length varying widely within a species given local environmental conditions (e.g. a longer growing season). A specimen of *P. maconochiei* near Mt Isa (BRI [AQ699277]) had an inflorescences of similar shape and length to specimens identified as *P. royceanus* from Queensland.

Given the discrete morphological differences between western *Ptilotus royceanus* and those recognised in Queensland by Bean (2008), the clear morphological overlap between Queensland *P. royceanus* specimens and *P. maconochiei*, and the geographic disjunction between the Queensland populations determined as *P. royceanus* and the range of western *P. royceanus* in Western Australia and Northern Territory (**Map 1**), we here recircumscribe *P. maconochiei* to include the Queensland specimens previously referred to as *P. royceanus*. Revised taxonomic concepts of the species within the *P. royceanus* group are given below.

Taxonomy

Ptilotus maconochiei Benl, *J. Adelaide Bot. Gard.* 1: 201–204, figs 1, 2 (1979). **Type:** Queensland. Burke District: Mt Isa, 8 March 1976, *G. Benl Au64 & J.R. Maconochie* (holo: M 0241487 *i.d.v.*; iso: AD 97904169 *i.d.v.*, B 100272696 *i.d.v.*, BM 000895592 *i.d.v.*, BRI [AQ0332686] *i.d.v.*, CANB 353258 *i.d.v.*, DNA D0013856 *i.d.v.*, G 00236989 *i.d.v.*, K 000357022 *i.d.v.*, M 0241488 *i.d.v.*, MEL 538277 *i.d.v.*, NSW 821430 *i.d.v.*, NY 00341969 *i.d.v.*, P 00609980 *i.d.v.*, PERTH 01558218).

Erect *shrubs* 30–100 cm high. *Stems* terete, their surface obscured by a densely tomentose indumentum of crisped nodose hairs; older stems woody and glabrescent. *Basal leaves* not seen. *Cauline leaves* obovate to broadly ovate or sometimes flabellate, 5–22 mm long, 5–26 mm wide, densely tomentose with crisped nodose hairs, the indumentum obscuring the surface; bases subsessile to petiolate, the petiole 1–5 mm long; margins entire. *Inflorescences* spiciform, terminal or axillary, solitary when axillary or in clusters of 2 or 3 when terminal, ovoid to cylindrical, pink, 15–30 mm long, 10–15 mm wide; apex acute. *Bracts* ovate, 1.9–2.1 mm long, 1.1–1.5 mm wide, abaxially densely tomentose with crisped nodose hairs, adaxially glabrous; midrib conspicuous, pink; apex acute, falcately curved. *Bracteoles* narrowly ovate, 1.8–2.3 mm long, 1.3–1.5 mm wide, abaxially densely tomentose with crisped nodose hairs, adaxially glabrous; midrib conspicuous, pink; apex acute, falcately curved. *Outer sepals* lanceolate, 4.8–6 mm long, 0.8–1.2 mm wide, pink, abaxially villous with spreading nodose hairs, adaxially glabrous; apex truncate, white, glabrous, with in-rolled margins. *Inner sepals* lanceolate, 4–5.8 mm long, 0.7–1 mm wide, pink, abaxially villous with spreading nodose hairs, adaxially glabrous; apex truncate to acute, glabrous, white, with in-rolled margins. *Fertile stamens* 5; *filaments* cream, 1.2–2.2 mm long, unequal in length, filiform; *anthers* cream or pink, 0.4–0.5 mm long, 0.2–0.3 mm

Fig. 6. Habit of ***Ptilotus maconochiei*** (*Purdie 8598*, CANB). Photo: M. Fagg (Australian Plant Image Index: dig 25946).

wide. *Staminal cup* symmetrical, not lobed, 0.6–0.8 mm long, glabrous. *Ovary* obovoid, pink, 0.9–1.4 mm long, 0.8–1.2 mm wide, densely villous with straight nodose hairs. *Style* straight, 1.6–2 mm long, centrally fixed on the ovary. *Stigma* unlobed, capitate. *Fruit* smooth, membranous. *Seed* glossy, black, 1.2–1.3 mm long, 0.9–1 mm wide. **Figs. 5 & 6**.

***Additional selected specimens examined*: Queensland.** Burke District: Oskar's valley, 15 km N of Mt Isa, Jun 1996, *Barrs SB24* (BRI); Mt Isa lookout, Sep 2005, *Johnston 05-101* (BRI); Tourist lookout near race course, Mt Isa, 9 Apr 1975, *George 12968* (PERTH); Fountain Range, 54 km SE of Mt Isa, Jul 1989, *Harris 411* (BRI). Gregory North District: Ayshire Hills, N of Winton, Sep 2008, *Fensham 5819* (BRI); NW of Winton (Ayrshire Hills), Sep 2005, *Johnston 0509-2* (BRI); Mt Edward Graves, Brighton Downs, Jul 2012, *Silcock JLS1243 & Winter* (BRI); Diamantina NP, Fly Mesa, Apr 1997, *Forster PIF20760 & Holland* (BRI). Mitchell District: Mt Stewart near Jundah, Sep 1984, *Hando s.n. & Joyce* (BRI [AQ396011]). Warrego District: Emmet Pocket Lookout, Idalia NP, Mar 1996, *Forster PIF18836 et al.* (BRI); Idalia NP, Emmet Pocket Lookout, Feb 2000, *Nicholls SN18* (BRI); Idalia National Park, Emmet Pocket Lookout area, Dec 2012, *Purdie 8598* (CANB); NW of Lisburne Homestead on Eton Vale boundary, Sep 2011, *Silcock JLS1017 & McRae* (BRI); 'Etonvale' Station, Jun 1984, *Blick s.n.* (BRI [AQ440577]); Tree Snake Hill, 8 km N of house, N of old mill, 4 km W of Blackall – Adavale road, Sep 2011, *Silcock JLS1026 & McRae* (BRI); Lynbryon, hills S of Scrubby Creek road, Jun 2011, *Silcock JLS903* (BRI). Gregory South District: Mt Henderson, 22 km E of Birdsville turnoff towards Windorah, Aug 2013, *Silcock JLS1558* (BRI); 72 km W of Windorah, Jul 1936, *Blake 12119* (BRI).

***Distribution and habitat*:** *Ptilotus maconochiei* is endemic to Queensland, in the Burke, Gregory North, Mitchell, Warrego and Gregory South pastoral districts **(Map 1)**. The habitat is typically described as slopes or edges of stony ridges, outcrops or mesas with laterite, shale or quartzite and with scattered vegetation consisting of *Acacia* Mill., *Eucalyptus* L'Her. or *Triodia* R.Br.

***Phenology*:** *Ptilotus maconochiei* has been collected flowering and fruiting from June to September, with outlying collections from February to April.

***Conservation status*:** *Ptilotus maconochiei* is listed as **Near Threatened** in Queensland under the *Nature Conservation (Wildlife) Regulation 2006*.

Ptilotus mollis Benl, *J. Roy. Soc. West. Aust.* 53: 4–5, fig. 3 (1970). **Type:** Western Australia. Gorge Range, Warralong Station, 1 May 1941, *N.T. Burbidge 780* (holo: PERTH 00999288)

Low rounded *shrubs* 30–40 cm high. *Stems* terete, densely villous with long, silky, nodose hairs that obscure the surface, becoming woody and glabrescent with age. *Basal leaves* not seen. *Cauline leaves* ovate to obovate, 10–28 mm long, 5–12 mm wide, densely silky-villous with nodose hairs obscuring the surface; bases subsessile to petiolate, petiole 1–6 mm long; margins entire. *Inflorescences* spiciform, axillary or terminal, arranged in a condensed panicle, cylindrical, 5–20 mm long, 6–8 mm wide, pinkish white; apex acute. *Bracts* broadly ovate to ovate, 1.8–2.1 mm long, 1.2–1.4 mm wide, abaxially densely villous with crisped, nodose hairs, adaxially glabrous; midrib conspicuous, brown; apex acute, slightly falcately curved. *Bracteoles* ovate to narrowly ovate, 2.3–2.5 mm long, 1–1.1 mm wide, abaxially densely villous with crisped, nodose hairs, adaxially glabrous; midrib conspicuous, brown; apex acute, slightly falcately curved. *Outer sepals* oblanceolate to lanceolate, 2.2–3 mm long, 1–1.1 mm wide, pink, abaxially villous with spreading nodose hairs, adaxially glabrous; apex acute, white, glabrous. *Inner sepals* lanceolate, 2–2.8 mm long, 0.6–0.9 mm wide, pink, abaxially villous with spreading nodose hairs, adaxially glabrous; apex acute, glabrous, white. *Fertile stamens* 5; *filaments* 0.5–1.1 mm long, unequal in length, filiform, cream; *anthers* 0.4–0.5 mm long, 0.2–0.3 mm wide, cream or pink. *Staminal cup* symmetrical, not lobed, 0.3–0.4 mm long, glabrous. *Ovary* obovoid, 0.7–0.9 mm long, 0.7–0.9 mm wide, white, densely villous with straight, nodose hairs. *Style* straight, 0.5–0.7 mm long, centrally fixed on the ovary. *Stigma* unlobed, capitate. *Fruit* smooth, membranous. *Seed c.* 1.4 mm long, *c.* 0.9 mm wide, glossy, dark brown. **Figs. 3 & 4**.

***Additional selected specimens examined*: Western Australia.** *c.* 15 km E of Port Hedland – Wittenoom Road, 77 km SW of Marble Bar, May 2011, *Saligari TRS 72-07 & Grantham* (PERTH); Ripon Hills, entrance to abandoned Ripon Hill Mining Centre, May 2001, *van Leeuwen 4845* (PERTH); *c.* 40 km SSW of Marble Bar on Panorama Station, Apr 2014, *Loudon WEC-001 et al.* (PERTH); *c.* 2.7 km E of Marble Bar Road & 28.4 km N of Nullagine, May 2013, *Woodman 100-03 & McFarlane* (PERTH); 60.9 km NNE of Nanutarra Roadhouse, Cane River Conservation Park, Jun 2011, *Dillon CR 9160 & Markey* (PERTH); WNW of Red Hill Station, outside of the West Pilbara Iron project area, Aug 2008, *True LCH 24941* (PERTH); 21.2 km W of Nullagine – Newman Road to Bamboo Springs Homestead, Aug 2004, *Chinnock 9657* (PERTH); Rudall River Region, Jun 1987, *Hart 955* (PERTH); 61 km NW of Tom Price, Sep 2007, *Thoma ET1317* (PERTH); *c.* 150 km SE of Port Hedland, 50 km E of the Great Northern Highway on western edge of Panorama Station, Aug 2010, *Stratton BS 02 & Saligari* (PERTH); *c.* 93 km WNW of Newman, Sep 2010, *Bull ONS JSF 338.02* (PERTH); *c.* 77 km NW of Newman on Great Northern Highway, Jul 2015, *Thiele 5254* (PERTH).

***Distribution and habitat*:** *Ptilotus mollis* is endemic in Western Australia, mostly in the Pilbara IBRA (Interim Biogeographic Regionalisation for Australia) bioregion but with the eastern-most occurrence in the Little Sandy Desert IBRA bioregion (**Map 1**). It is typically found on rocky scree slopes or hillsides, often with ironstone, on skeletal red or brown clayey loam soils, and it is typically associated with *Acacia* or *Triodia*-dominated plant communities.

***Phenology*:** Flowering and fruiting from May to August.

***Conservation status*:** *Ptilotus mollis* is listed by Smith & Jones (2018) as **Priority Four** under Conservation Codes of Western Australian Flora.

Ptilotus royceanus Benl, *J. Roy. Soc. West. Aust.* 53: 1–4, figs 1, 2 (1970). **Type:** Western Australia. Bungabiddy Rockhole, Walter James Range, 5 October 1966, *A.S. George 8314* (holo: PERTH 01139363; iso: B 100272695 *i.d.v.*, CANB 251193 *i.d.v.*, K 000357017 *i.d.v.*, M 0241502 *i.d.v.*, MEL 2279190 *i.d.v.*, NSW 821275 *i.d.v.*, PERTH 01139371, RSA 0000623 *i.d.v.*).

Erect or usually hanging, cremnophilous *subshrubs*, 30–60 cm high. *Stems* terete, densely woolly with crisped, nodose hairs

obscuring the surface, becoming woody and glabrescent with age. *Basal leaves* not seen. *Cauline leaves* orbicular to broadly ovate, 4–15 mm long, 4–10 mm wide, densely woolly with crisped, nodose hairs obscuring the surface; bases sessile to petiolate, petiole 0–2 mm long; margins entire. *Inflorescences* spiciform with interrupted or rarely loosely compact flowers, terminal or rarely axillary, pendulous, solitary, indeterminate shape, pink, 40–150 mm long, 8–10 mm wide; apex acute. *Bracts* ovate, 1.8–2.2 mm long, 0.6–1.2 mm wide, abaxially densely woolly with crisped, nodose hairs, adaxially glabrous; midrib conspicuous, pink; apex acute, falcately curved. *Bracteoles* narrowly ovate, 2–2.4 mm long, 0.8–1.2 mm wide, abaxially densely woolly with crisped, nodose hairs, adaxially glabrous; midrib conspicuous, pink; apex acute, falcately curved. *Outer sepals* lanceolate, 4.8–5.8 mm long, 0.6–0.8 mm wide, pink, abaxially villous with spreading nodose hairs, adaxially glabrous; apex truncate, white, glabrous, with in-rolled margins. *Inner sepals* lanceolate, 4.5–5.5 mm long, 0.5–0.7 mm wide, pink, abaxially villous with spreading nodose hairs, adaxially glabrous; apex truncate to acute, glabrous, white, with in-rolled margins. *Fertile stamens* 5; *filaments* 1.3–2.7 mm long, unequal in length, filiform, cream; *anthers* 0.4–0.5 mm long, 0.2–0.3 mm wide, cream or pink. *Staminal cup* symmetrical, not lobed, 0.2–0.4 mm long, glabrous. *Ovary* obovoid, pink, 0.9–1.2 mm long, 0.8–1 mm wide, densely villous to woolly with crisped, nodose hairs. *Style* straight, 1–1.4 mm long, centrally fixed on the ovary. *Stigma* unlobed, capitate. *Fruit* smooth, membranous. *Seed* glossy, *c.* 1.3 mm long, *c.* 0.9 mm wide, black. **Figs. 1 & 2**.

***Additional selected specimens examined*: Western Australia.** Bungabiddy Rockhole, NE of Ngaanyatara – Giles, Sandy Blight junction tract, Apr 2013, *Keighery s.n. & Moyle* (PERTH 08718202); 27 km N of Great Central Road on Sandy Blight Junction Road, Bungabiddy Rockhole, Jul 2013, *Brand 362* (PERTH); Bungabiddy Rockhole, *c.* 26 km N on the Sandy Blight Road from the Warakurna road at the main rockhole, Jun 2007, *Sweedman 7102* (PERTH); Bangalbirri [Bangalburi] Rockhole, Apr 1972, *Maconochie 1384* (BRI, MEL, PERTH); Pingkalpiri [Pungkilpirri] Rockhole, Walter James Range, Jun 1989, *Pearson DJP651* (PERTH); Walter James Range, Mar 1993, *Chapman 893* (PERTH); Glen Cumming, Rawlinson Range, Jul 1967, *George 8825* (PERTH); Pangkupirri [Pungkilpirri] Rockhole, Walter James Range, Sep 2006, *Vonow HPV3075 et al.* (PERTH); Just E of Pass of the Abencerrages, Rawlinson Range, Jul 1974, *George 12147* (PERTH); Glen Cummings, Rawlinson Range, 1972, *Robinson s.n.* (PERTH 00224057); Glen Cumming Gorge, Aug 2012, *Blake DD364* (PERTH). **Northern Territory.** W side of gorge, 24.6 km E of Docker River crossing, Aug 2013, *Jobson 10779 & Davis* (NT, PERTH); 0.5 mile [*c.* 0.8 km] E Ewalinga Rockhole, Petermann Ranges, Sep 1969, *Maconochie 780* (MEL, PERTH); Dean Range, Aug 1973, *Latz 4185* (MEL, PERTH).

***Distribution and habitat*:** *Ptilotus royceanus* is restricted to the Petermann Ranges on the Western Australia and Northern Territory border in the Central Ranges IBRA bioregion (**Map 1**), where it typically occurs in narrow rock crevices on the vertical walls of gorges composed of red sandstone. Nearby rocks are often dominated by *Triodia* spp. with scattered shrubs.

***Phenology*:** Flowering and fruiting from June to September, but with outlying collections from March and April.

***Conservation status*:** *Ptilotus royceanus* is listed as **Near Threatened** in the Northern Territory under the *Territory Parks and Wildlife Conservation Act*, but not listed as of conservation concern in Western Australia. Many Western Australian collections are from the same site, variously given as Pungkilpirri, Bungabiddy or Bangalburi Rockhole. The species may be restricted to just a few locations. Given its very restricted distribution and specific habitat, we recommend that the conservation status of *P. royceanus* in Western Australia be re-evaluated.

Key to the *Ptilotus royceanus* species group

1 Stems and leaves densely white-tomentose; sepals > 3.5 mm long; style > 0.9 mm long **2**
1. Stems and leaves densely silvery-grey silky-villous; sepals < 3.1 mm long; style < 0.8 mm long . . . . . **P. mollis**

2 Inflorescences interrupted or rarely loosely compact; staminal cup 0.2–0.4 mm long; style 1–1.4 mm long . . . . . **P. royceanus**
2. Inflorescences tightly compact; staminal cup 0.6–0.8 mm long; style 1.6–2 mm long . . . . . **P. maconochiei**

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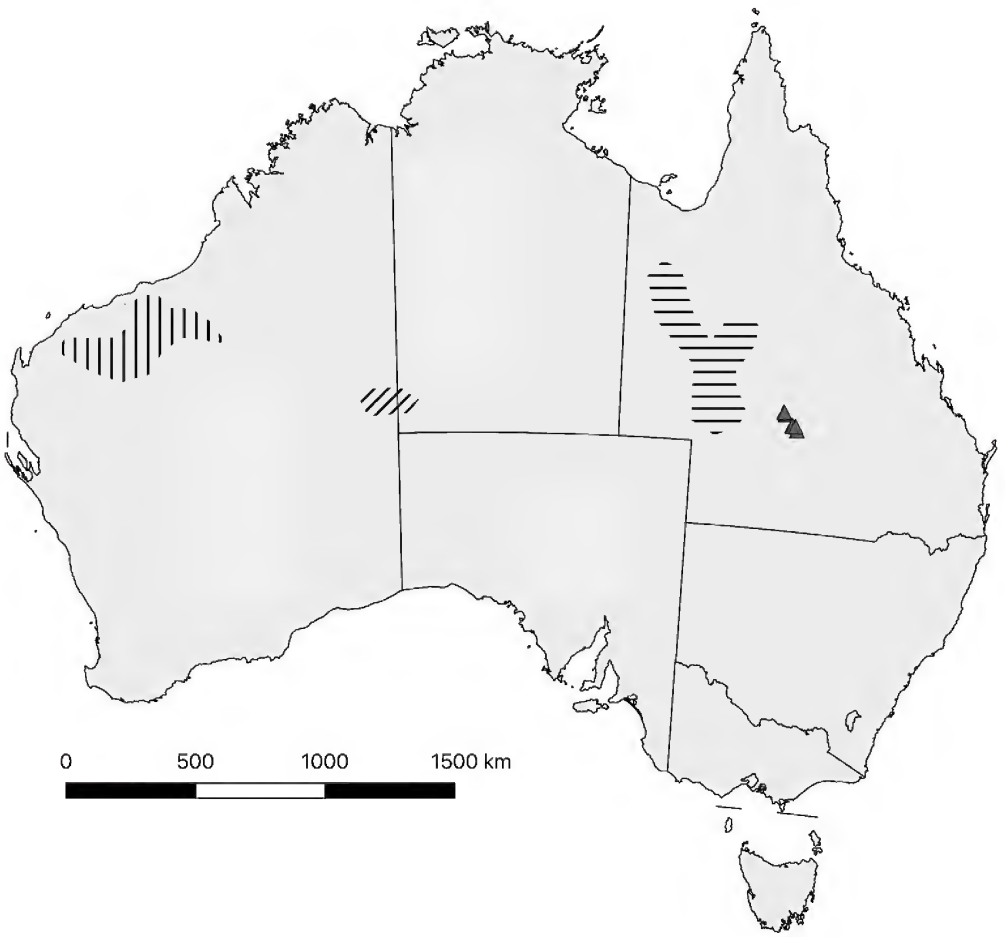

Map 1. The distributions of the three species as inferred from records retrieved from the Australasian Virtual Herbarium (http://avh.chah.org.au/): ***Ptilotus mollis*** (vertical shading), ***P. royceanus*** (diagonal shading), ***P. maconochiei*** (horizontal shading) and Queensland records of ***P. royceanus*** (triangles) *sensu* Bean (2008) reassessed in the present study.

Endiandra inopinata B.Gray (Lauraceae), a new species from Queensland's Wet Tropics

B. Gray

Summary

Gray, B. (2020). *Endiandra inopinata* B.Gray (Lauraceae), a new species from Queensland's Wet Tropics. ***Austrobaileya* 10(4): 639–644**. *Endiandra inopinata* B.Gray, a new species closely related to *E. insignis* F.M.Bailey but differing in floral and fruiting characteristics, is described and illustrated. The new species is restricted to the Mount Lewis and Mount Sorrow areas of the Wet Tropics rainforest of northeast Queensland.

Key Words: Lauraceae; *Endiandra*; *Endiandra inopinata*; Australia flora; Queensland flora; Wet Tropics rainforest; new species; taxonomy

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Introduction

Endiandra R.Br. (Lauraceae) is a genus of *c.* 100 species occurring in Asia, Malesia, Australia and the Pacific Islands with 38 species (33 or 34 species endemic) in Australia (Hyland 1989; Le Cussan & Hyland 2007). Rohwer (1993) using morphological and anatomical characters, included *Endiandra* in the '*Beilschmiedia* group' of the *Perseeae* Nees, along with *Beilschmiedia* Nees, *Brassiodendron* C.K.Allen, *Hexapora* Hook.f. and *Potameia* Thouars. *Endiandra* has been found to consistently group with *Beilschmiedia* based on molecular analyses (Rohwer & Rudolph 2005; Rohwer *et al.* 2014; van der Merwe *et al.* 2016; Song *et al.* 2019) and the two genera differ mainly in the orientation of the anther valves in the flower (Hyland 1989; Le Cussan & Hyland 2007). This apparent relationship is under question; however, as the recent more comprehensive study of Song *et al.* (2019) inferred a closer relationship between species of *Beilschmiedia* and *Syndiclis* Hook.f., with *Endiandra* sister to that group.

In Australia species of *Endiandra* occur from Torres Strait in Queensland to southern New South Wales, with one species extending to the Northern Territory. The majority of Australian *Endiandra* species occur in rainforest, gallery or littoral forests with only a few species extending to drier open forests.

The species described below was first collected flowering in June of 1996 by Paul Forster, Maurice Tucker and Garry Sankowsky, (*Forster PIF19236 et al.*), along the Mount Lewis Road and this collection and subsequent collections from there and the Mount Sorrow area were subsequently identified as *Endiandra insignis* F.M.Bailey; however, closer study has shown it to be a distinct species. This new species is endemic to the Queensland Wet Tropics bioregion and is here described as *E. inopinata* B.Gray.

Although relatively common where it occurs, with flowering occurring over a long period, fruiting specimens proved very difficult to find, but collections in December of 2017 have made it possible to complete the description of this species.

Materials and methods

All measurements and illustrations in this study are based on living plants in the field, herbarium specimens and spirit preserved materials from CNS and BRI. The description is modelled on those of Hyland (1989). Dimensions are inclusive, i.e. 1.0–1.7 is given as 1–1.7.

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Abbreviations used in the specimen citation include LA (Logging Area), SF (State Forest or State Forest Reserve), Mt (Mount or Mountain except where a designated National Park or State Forest name).

Taxonomy

Endiandra inopinata B.Gray **sp. nov.** Similar to *Endiandra insignis* F.M.Bailey but differing in anther filaments without glands and fruit 24–27 × 32–36 mm, opposed to anther filaments with glands, and fruits 60–80 × 65–100 mm in *E. insignis*. **Typus:** Queensland. Cook District: Mount Lewis Road, 11 km from Mount Molloy to Mossman Road, *B. Gray BG9411* (holo: BRI; iso: CNS).

Small tree to 12 m tall, poorly formed and often with two or more stems from ground level; stem to 15 cm dbh, without buttresses; bark nondescript. Twigs terete and clothed in pale brown to rusty hairs when young, becoming glabrescent. Leaves green on the underside, clothed in appressed, pale brown to rusty hairs, especially so on midrib and primary veins, upper surface glabrous. Leaf blade elliptical to ovate-elliptical, apex acute to acuminate, base cuneate, 5.8–14.5 × 2–6.5 cm; penninerved, primary veins 5–8 pairs (mode 6) flush on the upper surface, midrib flush on the upper surface. Inflorescence paniculate, terminal, axillary or on twigs below the leaves, clothed in rusty upright hairs, bracts narrowly triangular to linear, 0.8–2 × 0.2–0.4 mm. Flowers 3-merous, green, scarcely opening at anthesis, the tepals remaining erect and forming a tight sheath around the exserted anthers and style. Pedicel 0.8–1.5 × 0.7–0.9 mm. Perianth tube 1–1.9 × 2.7–3.2 mm at the widest point, but narrowing slightly at the apex where it ranges from 2.2–2.7 mm diameter, outer tepals 3, 1.2–1.5 × 1.8–2.3 mm, inner tepals 3, 1.1–1.3 × 1–1.3 mm, all tepals usually with sparse, appressed hairs on the inner surfaces, but only rarely on the outer surfaces. Anthers glabrous, opening sideways and outwards, 0.6–0.9 × 0.3–0.6 mm. Filaments 1–1.3 mm long, hairy, glands absent; staminodes usually 3, variable, linear to narrowly triangular, usually undifferentiated, hairy, 0.9–1.1 × 0.2–0.3 mm. Ovary sessile, *c.* 0.8 × 0.7 mm, glabrous; style 0.9–1mm long, glabrous. Fruits wider than long and slightly laterally compressed, 24–27 mm long and 32–36 mm wide, yellow pinkish yellow to orange when ripe; mesocarp + exocarp 2–2.5 mm thick; endocarp 0.2–0.3 mm thick; seed 16.5–21 × 19–25 mm; testa 0.2–0.3 mm thick; radicle central. Cotyledons cream to pinkish cream. **Figs. 1–4**.

***Additional specimens examined*: Queensland.** Cook District: Daintree NP, upper slope of Mt Sorrow walking track, Nov 2018, *Ford 5410* (BRI); Mt Sorrow walking track, Jul 2017, *Gray 9787 & Hawkes* (CNS); *ibid*, Dec 2017, *Gray 9961 & Hawkes* (CNS); SF 143, South Mary LA, Jun 1996, *Forster PIF19236, Tucker & Sankowsky* (BRI); 3.9 km from Bushy Creek bridge on Mt Lewis Road, Jun 2005, *Ford 4668* (CNS); 100 m past gate at grassy clearing on Mt Lewis Road, Dec 2017, *Jensen 3892 & McKenna* (BRI); 12.1 km on Mt Lewis Road from Julatten – Mossman Road, Nov 2005, *Halford Q8831 & Jensen* (BRI); 6.8 km past gate on Mt Lewis Road, Nov 2005, *Halford Q8838 & Jensen* (BRI); Mt Lewis Road, Aug 2009, *Gray 9297* (CNS); Mt Lewis access Road, Jan 2012, *Gray 9481* (CNS); *ibid*, Aug 2013, *Gray 9577* (CNS); Mt Lewis Road, 12 km from Mt Molloy – Mossman Road, Jan 2012, *Gray 9482* (CNS); Mt Lewis Road 300 m before Finch clearing, Apr 2016, *Gray 9776 & Hawkes* (CNS); Mt Lewis Road, 9.5 km from Mt Molloy – Mossman Road, Apr 2016, *Gray 9777 & Hawkes* (CNS); *ibid*, Dec 2017, *Gray 9957 & Ford* (CNS); Mt Lewis Road, 11.1 km from Mt Molloy – Mossman Road, Dec 2017, *Gray 9956 & Ford* (CNS); Mt Lewis Road, 9.5 km from Mt Molloy – Mossman Road, 100 m before Finch clearing, June 2018, *Gray 9971* (CNS).

***Distribution and habitat*:** *Endiandra inopinata* is so far recorded from two small areas, Mt Lewis Road in the Brooklyn Wildlife Sanctuary and Mount Lewis National Park, and along the Mt Sorrow walking track within the Daintree National Park; however, it is likely because of the lack of access to this portion of the Wet Tropics, that the species may well occur in a broader area (**Map 1**).

Endiandra inopinata grows as an understory tree in an area of high rainfall in montain rainforest (complex notophyll to mesophyll vineforest) at altitudes between 250 and 1100 m, on soils derived from granite and can at times be locally common.

***Phenology*:** Flowers have been recorded in January to August, while ripe fruits have been recorded in December and January. Flowering has been observed on trees as small as 4 metres tall.

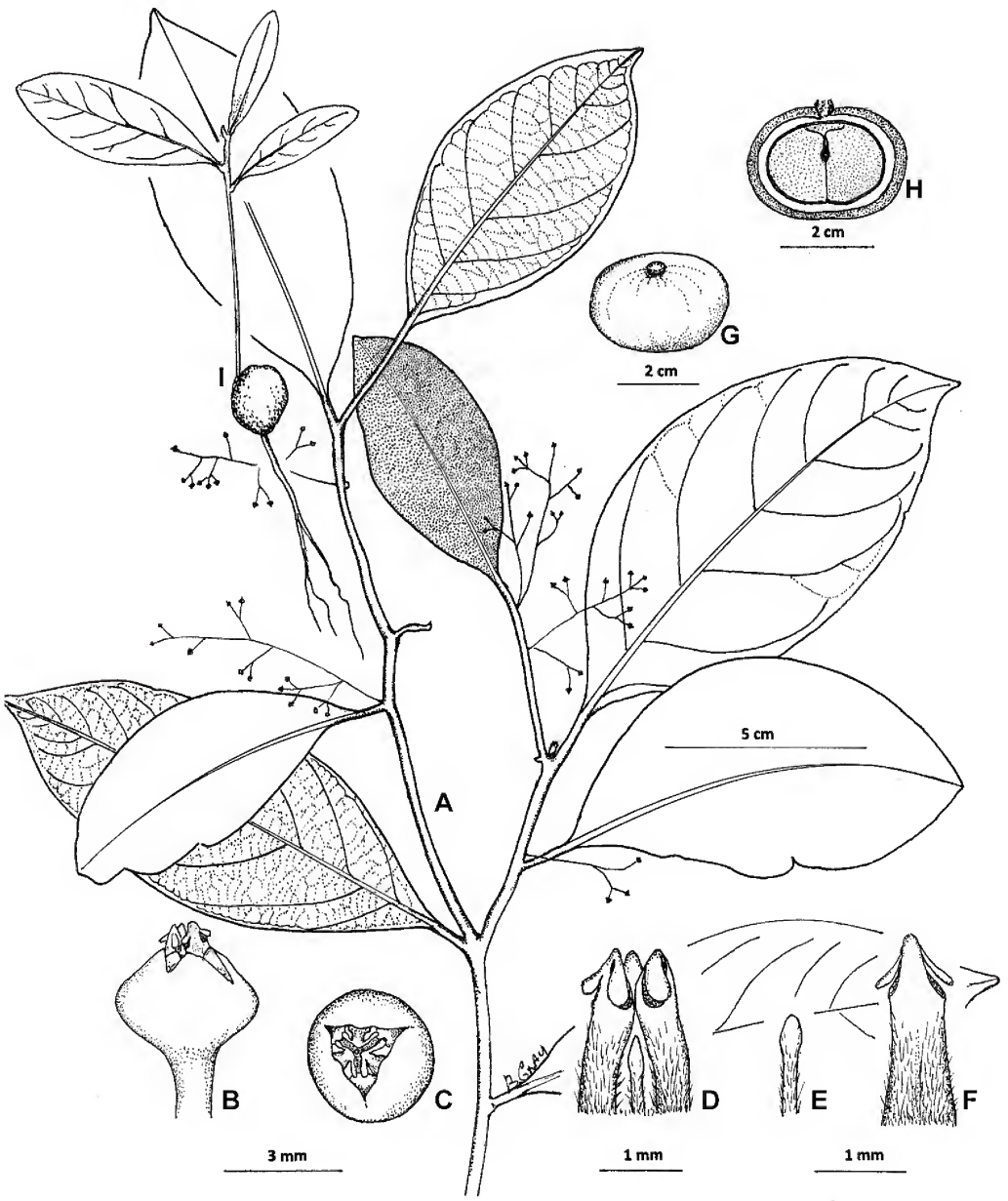

Fig. 1. ***Endiandra inopinata***. A. habit of flowering branchlet. B. flower (lateral view). C. flower (top view). D. anthers and staminode (lateral view). E. staminode. F. anther (adaxial view) . G. fruit. H. section through fruit. I. seedling. Scales as indicated. A–F from *Gray BG9411* (CNS); G & I from *Jensen 3892* & *McKenna* (BRI); H from *Gray 9956 & Ford* (CNS). Del. B. Gray.

Fig. 2. Flowering plant of ***Endiandra inopinata*** (*Gray BG9971*, CNS). Photo: B. Gray.

Fig. 3. Inflorescence and flowers of ***Endiandra inopinata*** (*Gray BG9971*, CNS). Photo: B. Gray.

Fig. 4. Ripe fruit of ***Endiandra inopinata*** (*Jensen 3892 & McKenna*, BRI). Photo: R. Jensen.

***Notes*:** *Endiandra inopinata* is most similar to *E. insignis*, but differs in being a small tree usually with basal coppice and/or multiple stems less than 15 cm diameter, with fruits to 36 mm diameter, compared to *E. insignis* which grows to a tree 25 m tall × 80 cm dbh, with fruits 65–100 mm diameter (Hyland 1989). *E. inopinata* has very distinctive pinkish-red new growth leaves during the wet season which make the tree easily recognised at that time of the year.

***Etymology*:** The specific epithet is derived from the Latin *inopinatus* (unexpected) and refers to the unexpected discovery of this new species in areas that have been frequently botanised.

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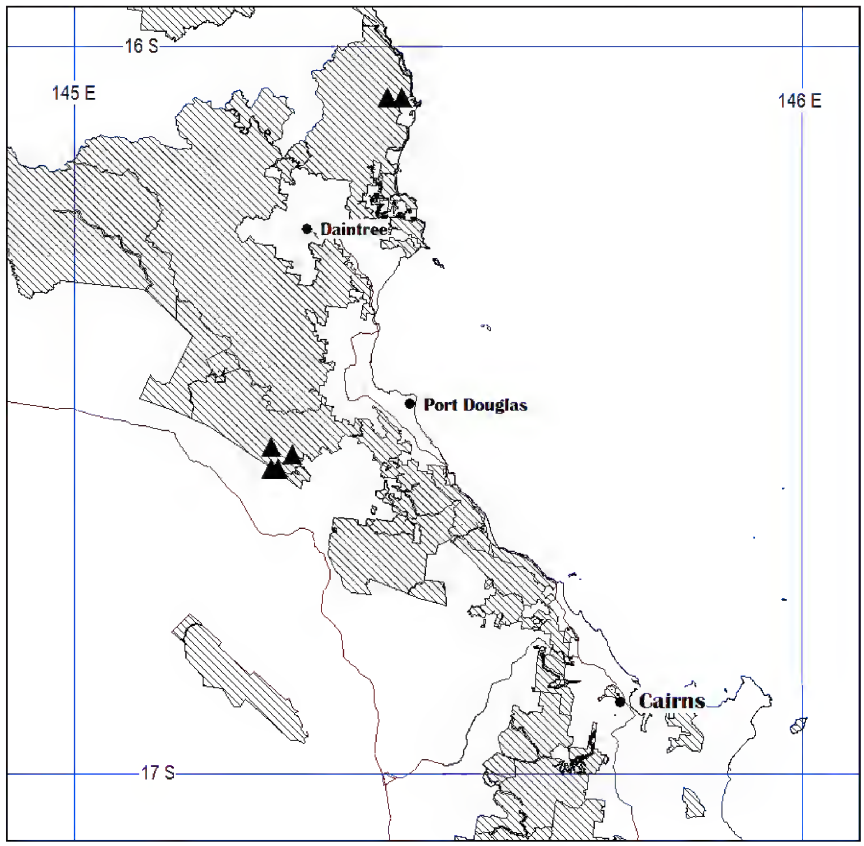

Map 1. Distribution of ***Endiandra inopinata***. Cross hatching indicate the conservation estate.

Taxonomic notes on the *Melaleuca leucadendra* (L.) L. group (Myrtaceae) in Queensland

A.R. Bean

Summary

Bean, A.R. (2020). Taxonomic notes on the *Melaleuca leucadendra* (L.) L. group (Myrtaceae) in Queensland. ***Austrobaileya* 10(4): 645–655**. *Melaleuca oblivia* A.R.Bean and *M. stenostachya* subsp. *amplior* A.R.Bean are newly described, and *M. nervosa* subsp. *crosslandiana* (W.Fitzg.) Barlow ex Craven is reinstated. Distribution maps and illustrations are provided for all taxa discussed. An identification key for all Queensland members of the *M. leucadendra* group is included.

Key Words: Myrtaceae; *Melaleuca leucadendra*; *Melaleuca nervosa* subsp. *crosslandiana*; *Melaleuca nervosa* subsp. *nervosa*; *Melaleuca oblivia*; *Melaleuca stenostachya* subsp. *amplior*; Australia flora; Queensland flora; new species; new subspecies; identification key; distribution maps

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Introduction

The genus *Melaleuca* L. has around 290 species and is distributed throughout Australia, New Caledonia, Papua New Guinea, Indonesia and mainland south-east Asia (Brophy *et al*. 2013). Eighty species are currently recognised for Queensland, and occur in virtually all habitats except rainforest and mangroves.

Perhaps the most taxonomically difficult Queensland species belong to the *Melaleuca leucadendra* (L.) L. group, sometimes known as the broad-leaved paperbarks. Bentham (1867), with the material available to him, recognised just two species in the group, namely *M. lasiandra* F.Muell. and a polymorphic *M. leucadendra*. Blake (1968) brought order from taxonomic and nomenclatural chaos in a comprehensive and insightful monograph of the *M. leucadendra* group, where he accounted for around 100 published names relating to the group, including many that were misapplied, and described two new species. His study was based on both herbarium specimens and extensive field studies, and he discovered several important taxonomic characters that have proved to be of considerable value in distinguishing species. Byrnes (1984, 1985, 1986) revised the genus *Melaleuca* for northern and eastern Australia, and in the *M. leucadendra* group he named several new varieties and formas of existing species, most of which are no longer accepted. Barlow & Forrester (1984) suggested that *M. crosslandiana* W.Fitzg. should be made a subspecies of *M. nervosa* (Lindl.) Cheel (later validated by Craven (1999)) though subsequently sunk by Craven & Cowie (2013), and Barlow (in Craven & Barlow 1997) described three new Queensland taxa: *M. fluviatilis* Barlow, *M. cajuputi* subsp. *platyphylla* Barlow and *M. clarksonii* Barlow.

Fifteen species belonging to the *Melaleuca leucadendra* group are currently recognised for Queensland, and in this paper, *M. oblivia* A.R.Bean and *M. stenostachya* subsp. *amplior* A.R.Bean are newly described, and *M. nervosa* subsp. *crosslandiana* (W.Fitzg.) Barlow ex Craven is reinstated.

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Materials and methods

This paper is based on an examination of around 650 *Melaleuca* specimens held at BRI, and type specimen images on the JSTOR website. All measurements are based on dried herbarium material. Dimensions are inclusive, *viz.* 1.0–1.7 is given as 1–1.7.

In the specimen citations, common abbreviations are Mt (Mountain or Mount) and NP (National Park).

Distribution maps are provided for all the taxa taxonomically discussed and were compiled using DIVA-GIS Version 7.5.0, using geocodes given on the labels of the specimens examined.

A key to all *Melaleuca* species occurring in Queensland is available on the internet (Keybase 2019); however, a key to just the species in the *M. leucadendra* group is provided here.

Taxonomy

Key to taxa of the *Melaleuca leucadendra* group in Queensland[1]

1 Inflorescences and infructescences in globose or ellipsoidal heads, or short spikes < 30 mm long **2**
1. Inflorescences and infructescences spicate, spikes 30–150 mm long **3**

2 Adult leaf apex obtuse; hypanthium sparsely hairy with hairs 0.4–0.6 mm long; capsules 3.5–4.5 mm diameter; anther cells 0.4–0.5 mm long. . . . . **M. arcana**
2. Adult leaf apex acute; hypanthium densely hairy with hairs 0.1–0.3 mm long; capsules 2.5–3.3 mm diameter; anther cells 0.3–0.4 mm long. . . . . **M. saligna**

3 Larger leaves 25–35 mm long; stamens conspicuously hairy . . . . . **M. lasiandra**
3. Larger leaves 40–150 mm long; stamens glabrous 4

4 Young leaves with many short crisped hairs, and usually with some long straight hairs (spreading or appressed) **5**
4. Young leaves with straight appressed hairs only, often silky, or leaves glabrous 7

5 Hypanthium and rachis sparsely to densely hairy, but surface of hypanthium/rachis readily visible with hand lens; fruits persistent for > 12 months. . . . . **M. fluviatilis**
5. Hypanthium and rachis with very dense white hairs, obscuring surface of hypanthium/rachis; fruits deciduous soon after maturity **6**

6 Inflorescence 17–23 mm across; anther cells 0.7–0.8 mm long; mainly in dune swales near the coast . . . . . **M. dealbata**
6. Inflorescence 30–45 mm across; anther cells 0.45–0.75 mm long; widespread in inland areas . . . . . ***M. nervosa** subsp. **nervosa**

7 Rachis and hypanthium glabrous **8**
7. Rachis hairy, and hypanthium usually hairy **11**

8 Stamen bundles 5–8 mm long; fruits 3–4 mm diameter; hairs on leaves 0.1–0.2 mm long . . . . . **M. clarksonii**
8. Stamen bundles 9–22 mm long; fruits 4.5–6.5 mm diameter; leaf hairs 0.2–0.8 mm long or absent **9**

[1]Only those taxa (indicated*) that are newly named or reinstated are dealt with in detail in the subsequent text.

9 Inflorescences 24–30 mm wide; new growth sparsely hairy . . . . . **M. leucadendra**
9. Inflorescences 31–54 mm wide; new growth densely hairy **10**

10 Leaves 7–11 times longer than wide . . . . . **M. viridiflora** var. **attenuata**
10. Leaves 2–7 times longer than wide . . . . . **M. viridiflora** var. **viridiflora**

11 Leaves narrow, 7–14 times longer than broad **12**
11. Leaves broad, 1.7–7 times longer than broad **16**

12 Inflorescences 12–16 mm wide **13**
12. Inflorescences 22–42 mm wide **14**

13 Larger leaves 3–8(–9) mm wide; fruit diameter 1.9–2.7(–3) mm . . . . . ***M. stenostachya** subsp. **stenostachya**
13. Larger leaves (7–)8–14 mm wide; fruit diameter 2.7–3.3 mm . . . . . ***M. stenostachya** subsp. **amplior**

14 Leaves 3-veined; fruits 2.7–3.3 mm diameter . . . . . ***M. oblivia**
14. Leaves 5–7-veined; fruits 3.6–5.2 mm diameter **15**

15 Inflorescences 75–90 mm long and 22–29 mm wide; anther cells 0.8–1.1 mm long; leaf hairs semi-persistent . . . . . **M. argentea**
15. Inflorescences 40–60 mm long and 25–42 mm wide; anther cells 0.5–0.75 mm long; leaf hairs readily deciduous . . . . . **M. fluviatilis**

16 Inflorescences 16–18 mm diameter; fruits 3.2–3.7 mm diameter . . . . . **M. cajuputi** subsp. **platyphylla**
16. Inflorescences 23–54 mm diameter; fruits 3.5–7 mm diameter **17**

17 Longer leaves 120–180 mm long and 25–44 mm wide. . . . **M. viridiflora** var. **viridiflora**
17. Longer leaves 50–120 mm long and 8–25 mm wide **18**

18 Inflorescences 23–32(–40) mm wide; fruits 4–6 mm wide, persistent; absent from Burke and Gregory North districts . . . . . **M. quinquenervia**
18. Inflorescences 30–45 mm wide; fruits 3.5–4 mm wide, readily deciduous; Burke and Gregory North districts only . . . . . ***M. nervosa** subsp. **crosslandiana**

Melaleuca oblivia A.R.Bean **sp. nov.** with affinity to *M. stenostachya* S.T.Blake, but differing by the longer stamens and style, the inflorescences with widely spaced triads, the larger anthers, and the shorter hairs on the rachis and leaves. **Typus:** Queensland. Cook District: Mungkan Kandju National Park, 3 October 2008, *K.R. McDonald KRM7960 & J.W. Winter* (holo: BRI; iso: CANB, MEL, NSW, *distribuendi*).

Tree 5–15 m high. Bark grey to white, papery, persistent thoughout. Branchlets terete, grey to brown; hairs absent or sparse, appressed, straight. Leaves simple, entire, spirally arranged, not pendulous (*fide Neldner 2832 & Clarkson*); petioles ill-defined, 5–11 mm long, flattened; lamina linear to narrowly-oblanceolate, 57–129 × 6–13 mm, 7–12 times longer than wide, with 3 prominent raised longitudinal veins, any additional veins not extending for more than 50% of leaf length; oil glands sparse, 12–16 per mm^2; hairs simple appressed, silky, 0.1–0.25 mm long, sparse to dense on young laminae, becoming glabrous with age; apex acuminate to apiculate, base cuneate, margins flat. Inflorescences spicate, spikes 35–75 mm long, 26–34 mm wide; rachis with sparse to moderately dense patent to antrorse white straight hairs, 0.05–0.15 mm long; flowers in triads, 5–merous, sessile, bracteoles not seen; triads (3–)5–11 mm apart on the rachis. Hypanthium obconical to cupular, 1.5–1.9 mm long, with sparse patent white hairs *c.* 0.1 mm long; sepals hemispherical to deltate, 0.5–0.7 mm long, with several large globose oil glands, glabrous

to sparsely hairy on outer surface, glabrous to sparsely hairy on inner surface, deciduous; petals broadly obovate, 1.2–2.1 mm long, white, outer surface glabrous, inner surface glabrous, margin sometimes with a few hairs, oil glands linear to elliptical. Stamens white, in 5 bundles, 4–6 stamens per bundle, bundles 11–13 mm long, filaments glabrous; anthers versatile, 0.5–0.7 mm long. Ovary 3-locular; summit of the ovary densely hairy; style 10–16 mm long, glabrous; stigma slightly expanded. Mature fruits cupular, 2.5–3.0 mm long, 2.6–3.2 mm diameter, sessile, glabrous or glabrescent, valves of capsule enclosed. **Fig. 1A,B,E,G**.

***Additional specimens examined*: Queensland.** Cook District: Edward River Aboriginal Reserve, 2 km from Nutwood crossing, Oct 1980, *Clarkson 3526* (BRI); Weipa, back of rubbish tip, Oct 1981, *Morton AM1540* (BRI); 2 km N of Archer River, Oct 1984, *Gray 3652* (BRI); *c.* 25 km SSW of Aurukun and 0.5 km W of the Archer River, Oct 1982, *Clarkson 4547* (BRI); Stone Crossing, Wenlock River, Oct 1980, *Hyland 10774* (BRI); 1.5 km ESE of Aurukun on track leading to Watson River, Dec 1981, *Clarkson 4079* (BRI, CANB, CNS, K, NT, PERTH); between Cattle Creek and Coal Seam Creek on Lakeland to Laura Road, Oct 2000, *Jago 5765 & Wannan* (BRI, DNA); Batavia Downs, 6.4 km from Peninsula Development Road on track to lagoons on Wenlock River, Oct 1989, *Neldner 2832 & Clarkson* (BRI, CANB, CNS); *ibid*, Oct 1989, *Neldner 2833 & Clarkson* (BRI, CANB, CNS); Orchid Creek Station, W of Lockhart River, Oct 2013, *McDonald KRM14941 & Thompson* (BRI); 30 miles [48 km] SSE of 'Strathleven', Nov 1965, *Pedley 1842* (BRI); *c.* 24–26 km SE of Coen, on Laura – Coen road, Oct 1962, *Smith 12021* (BRI); Lama Lama NP, Goose Lagoon, Bull Swamp track, Jul 2016, *McDonald KRM18760* (BRI); 11 km ENE of Weipa mission, Jul 1974, *Specht W351 & Salt* (BRI); Oyala Thunstang NP, 6.2 km along Rokeby Road, Sep 2013, *McDonald KRM14849* (BRI); Running Creek Nature Refuge, start of timber extraction track near dam, Oct 2018, *McDonald KRM20804* (BRI); Running Creek Nature Refuge, 25.6 km along Lilyvale Road from Port Stewart Road junction, Oct 2018, *McDonald KRM20802* (BRI); 9 km N of Morehead River on Peninsula Development Road, Apr 1980, *Clarkson 3116* (BRI).

***Distribution and habitat*:** *Melaleuca oblivia* is endemic to Queensland where it is confined to Cape York Peninsula, extending from Batavia Downs to Laura and west to Kowanyama and Weipa (**Map 1**). It usually grows in woodland on sandy soils, but sometimes on clayey soils fringing lagoons. Associated species include *Eucalyptus tetrodonta* F.Muell., *E. brassiana* S.T.Blake, *Corymbia clarksoniana* (D.J.Carr & S.G.M.Carr) K.D.Hill & L.A.S.Johnson, *Melaleuca viridiflora* Sol. ex Gaertn., *Syzygium suborbiculare* (Benth.) T.G.Hartley & L.M.Perry, *Grevillea pteridifolia* Knight, *Acacia crassicarpa* A.Cunn. ex Benth. and *A. torulosa* Benth.

***Phenology*:** Flowers in September and October; fruits recorded for July, November and December.

***Affinities*:** The closest putative relative of *Melaleuca oblivia* on the basis of morphology is unclear. Several specimens had been previously identified as either *M. stenostachya* or *M. fluviatilis*, and it has similarities to both these species. *M. oblivia* differs from *M. stenostachya* subsp. *amplior* by the stamen bundles 11–13 mm long (5–8 mm long for *M. stenostachya* subsp. *amplior*); style 10–14 mm long (6–9 mm for *M. stenostachya* subsp. *amplior*); flower triads (3–) 5–11 mm apart (2–4 mm apart for *M. stenostachya* subsp. *amplior*); anther cells 0.5–0.7 mm long (0.3–0.4 mm for *M. stenostachya* subsp. *amplior*); leaf hairs 0.1–0.25 mm long (0.2–1.2 mm long for *M. stenostachya* subsp. *amplior*); rachis hairs patent to antrorse, 0.05–0.15 mm long (appressed, 0.3–0.7 mm long for *M. stenostachya* subsp. *amplior*); and the leaves 3-veined (usually 5-veined for *M. stenostachya* subsp. *amplior*).

Melaleuca oblivia differs from *M. fluviatilis* by the hairs on the young leaves consistently straight and appressed (usually with many crisped hairs for *M. fluviatilis*), the leaves 3-veined, veins raised (usually 5-veined, veins not raised in *M. fluviatilis*), the rachis hairs 0.05–0.15 mm long (0.2–0.5 mm long for *M. fluviatilis*), and the fruits 2.7–3.3 mm diameter (3.6–5.2 mm diameter for *M. fluviatilis*).

***Notes*:** *Melaleuca oblivia* is characterised by the slender, often oblanceolate trinerved leaves (non-pendulous according to *Neldner 2832 & Clarkson*), the short antrorse hairs on the rachis, the widely spaced triads of the inflorescence, and the small fruits. Some collectors (*Smith 12021*; *Neldner 2832 & Clarkson*; *Morton AM1540*) have described

Fig. 1. ***Melaleuca oblivia***. A. flowering branchlet ×0.5. B. fruiting branchlet ×0.5. E. leaf ×1. G. rachis and fruits showing indumentum ×10. ***M. stenostachya*** subsp. ***amplior.*** D. leaf ×1. F. fruiting branchlet ×2. H. rachis and flower buds showing indumentum ×10. ***M. stenostachya*** subsp. ***stenostachya***. C. leaf ×1.5. A, E from *McDonald KRM14849* (BRI); B from *Neldner 2832 & Clarkson* (BRI); C from *Fox IDF261* (BRI); D,H from *Stanton JPS3941 & Fell* (BRI); F from *Crisp 10277 & Morris* (BRI); G from *McDonald KRM7960 & Winter* (BRI). Scale bar = 10 mm at ×1 magnification. Del. N. Crosswell.

the bark as fibrous or somewhat fibrous, but other collectors describe it merely as 'paperbarked'.

***Conservation status*: Least Concern** (IUCN 2012). There are 17 known collections of *M. oblivia*, over a geographical range of 400 × 150 km, and it does not appear to be confined to a rare or unusual habitat.

***Etymology*:** From the Latin *oblivius* meaning 'sunk into oblivion', 'ignored' or 'forgotten'. This name is given because this species, first collected in 1962, has been apparently overlooked by taxonomists.

Melaleuca stenostachya S.T.Blake, *Contr. Queensland Herb.* 1: 50 (1968); *M. stenostachya* var. *stenostachya*, Byrnes, *Austrobaileya* 2: 74 (1984). **Type:** Queensland. Burke District: Croydon, 16 July 1954, *S.T. Blake 19566* (holo: BRI; iso: NSW).

Shrub or tree 3–12 m high. Bark grey to white, papery, persistent thoughout. Branchlets terete, grey to brown; hairs absent or sparse, appressed, eglandular. Leaves simple, entire, spirally arranged; petioles ill-defined, 1–2 mm long, flattened; lamina linear to elliptical or lanceolate, 35–90 × 3–14 mm, 4–15 times longer than wide, (3–)5(–7)-veined; oil glands moderately dense, *c.* 20 per mm^2; hairs simple appressed, silky, 0.2–1.2 mm long, dense on young laminae, becoming glabrous with age; apex acute, base cuneate, margins flat. Inflorescences spicate, spikes 30–45 mm long; rachis with dense appressed to antrorse white eglandular hairs, 0.3–0.7 mm long; flowers in triads, 5-merous, sessile, bracteoles very small, caduceus; triads 2–4 mm apart along the rachis. Hypanthium cylindrical to cupular, 1.2–1.6 mm long, with dense appressed white hairs 0.2–0.5 mm long; sepals ovate-truncate, 0.6–1.1 mm long, oil glands circular to elliptical, glabrous to densely hairy on outer surface, glabrous on inner surface, deciduous; petals broadly obovate, 1.1–1.9 mm long, white, hairs present on margin, otherwise glabrous, oil glands circular to elliptical. Stamens white, in 5 bundles, 5–9 stamens per bundle, bundles 5–8 mm long, filaments glabrous; anthers versatile, 0.3–0.4 mm long. Ovary 3-locular; summit of the ovary densely hairy; style 6–9 mm long, glabrous; stigma slightly expanded. Mature fruits globose-truncate, 1.9–3.3 mm long, 1.9–3.3 mm diameter, sessile, glabrous or glabrescent, valves of capsule enclosed.

***Notes*:** *Melaleuca stenostachya* is characterised by the short stamens, short cylindrical inflorescences, the appressed to antrorse silky hairs on the rachis, and the small fruits. The species is typified by a specimen from Croydon in north-western Qld, and plants from that region and into the NT have relatively narrow leaves with the hairs rather persistent. Specimens from Cape York Peninsula that conform florally to *M. stenostachya* are nevertheless distinct in appearance due to their quite broad leaves that lose their indumentum very quickly, and the somewhat larger fruits. These latter collections are here separated as *M. stenostachya* subsp. *amplior*.

Key to the subspecies of *Melaleuca stenostachya*

Fruit diameter 1.9–2.7(–3) mm; larger leaves 3–8(–9) mm wide, 35–65 mm long, indumentum semi-persistent; calyx lobes densely hairy . . . . . **M. stenostachya** subsp. **stenostachya**

Fruit diameter 2.7–3.3 mm; larger leaves (7–)8–14 mm wide, 50–90 mm long, indumentum quickly lost; calyx lobes glabrous or very sparsely hairy . . . . . **M. stenostachya** subsp. **amplior**

Melaleuca stenostachya subsp. **stenostachya** Larger leaves 35–65 mm long, 3–8(–9) mm wide, indumentum semi-persistent. Calyx lobes densely hairy. Fruits 1.9–2.7(–3) mm diameter. **Fig. 1C**.

***Additional selected specimens examined*: Northern Territory.** 24 miles [39 km] N of McArthur River Station, Jul 1948, *Perry 1776* (BRI); 32.1 km NNE of Pungalina Homestead on track to Calvert River mouth on Pungalina/Seven Emu Wildlife Sanctuary, Jul 2012, *Jensen 2660 & Kemp* (BRI). **Queensland.** Cook District: Entrance gate to Brooklyn, Bethel's Crossing track, a few km west of Mt Carbine, Feb 2006, *Kemp JEK6472* (BRI); Dorunda Station, opposite homestead airstrip, Jun 1990, *Neldner 2936 & Clarkson* (BRI, CANB, CNS, L); near Chillagoe, Apr 1936, *Blake 13564* (BRI). Burke District: S of Croydon on Mittagong Station, Jun 1999, *Fox IDF261* (BRI).

Melaleuca stenostachya subsp. **amplior** A.R.Bean **subsp. nov.**, differing from *M. stenostachya* subsp. *stenostachya* by the larger (50–90 × 7–14 mm), quickly glabrescent leaves and the often larger fruits. **Typus:** Queensland. Cook District: 11.8 km E of Bromley on the track to Carron Valley, 10 July 1990, *J.R. Clarkson 8889 & V.J. Neldner* (holo: BRI; iso: CANB, DNA, K).

Leaves 50–90 mm long, (7–)8–14 mm wide, indumentum quickly lost. Calyx lobes glabrous or very sparsely hairy. Fruits 2.7–3.3 mm diameter. **Fig. 1D,F,H**.

Additional selected specimens examined (from 49 total): **Queensland**. Cook District: Hammond Island, Torres Strait, Mar 2006, *Waterhouse BMW7362* (BRI, CANB, NSW); Pulu Islet, off western shore of Mabuiag Island, Torres Strait, Apr 2009, *Fell DGF10015* (BRI, CNS); Tip of Cape York, car park, Sep 2006, *Crisp 10277 & Morris* (BRI, CANB); Base of Mt Bremer, western side, Feb 1994, *Stanton JPS3941 & Fell* (BRI); Mosquito Point, N of Pascoe River, Dec 1977, *Webb & Tracey 13574* (BRI, CNS); Weipa 'Jump Up' road, 1 km along road from Coen intersection, May 1989, *Armstrong BF53* (BRI); 12 km E of Strathhaven Homestead on the Musgrave – Edward River Road, Oct 1980, *Clarkson 3470* (BRI, CANB, CNS, K, L, MO, NSW, NT, PERTH, PRE); Orchid Creek Station, Fox Creek, SW of Lockhart River, Cape York Peninsula, Apr 2014, *McDonald KRM15651 et al.* (BRI); 12.2 km N of old road junction on road to Portland Roads, Jul 1991, *Neldner 3578 & Clarkson* (BRI, CANB, CNS, DNA); 0.8 km E of the Koolatah turnoff on the Oroners – Sefton road, Jun 1981, *Clarkson 3767* (BRI, CNS, K, MO, NSW, NT, PERTH); 6.7 km E of the Peninsula Development Road on the road to Iron Range, Jul 1985, *Clarkson 6123* (BRI, CANB, CNS, DNA, PERTH); Cape Griffith ridge, Iron Range NP, NE Cape York Peninsula, Jun 1990, *Fell DF2125* (BRI); Orchid Creek Station, Dolphin Mountain; SW of Lockhart River, Cape York Peninsula, Apr 2014, *Forster PIF41132 et al.* (BRI, MEL, NSW); S approach to Rosser Creek on the Gamboola – Strathleven Road, Jul 2003, *Fox IDF2277* (BRI, DNA, NSW); Peninsula Development Road, 16.3 km S of Coen, Feb 1999, *Jago 5138 & Wannan* (BRI, CANB); Flinders Island, Jun 1995, *Le Cussan 582* (BRI); Chuula Lagoon, Kaanju Nation, Central Cape York, Jun 2005, *Smith 4886 & Claudie* (BRI); *c.* 8 km SE of Laura on Peninsula Development Road, Jul 1985, *Barlow 3893 & Thiele* (BRI, CANB); Cooktown, Jan 1958, *Blake 20221* (BRI); Lakeland Downs, *c.* 24 km S of Roadhouse on Peninsula Development Road, Oct 2009, *Halford & Petoe BGQLD0658* (BRI).

***Distribution and habitat*:** *Melaleuca stenostachya* subsp. *amplior* is endemic to Queensland where it occurs from the islands of the Torres Strait, south to Cooktown and Lakeland Downs (**Map 2**). It inhabits hills or sandy flats in open woodland or woodland dominated by eucalypts, or by *Melaleuca viridiflora*. It is also known from windswept granite headlands along the east coast.

***Phenology*:** Flowers are commonly recorded from January to April, and there is a single flowering record from June; fruits are recorded from April to December.

***Notes*:** Some *Melaleuca stenostachya* specimens from southern Cape York Peninsula, including Cooktown, Mount Carbine and Lakeland Downs, are intermediate in their leaf width and fruit diameter, and are difficult to assign to either subspecies.

The type specimen of *Melaleuca stenostachya* var. *pendula* Byrnes is referrable to *M. saligna* Schauer. The form of *M. saligna* from northern Cape York Peninsula is very similar to *M. stenostachya* subsp. *amplior* in leaf size and shape, inflorescence diameter, and sometimes inflorescence length, but they differ markedly in the indumentum of the inflorescence rachis and hypanthium; in *M. saligna* the hairs are short and erect, while in *M. stenostachya* they are long and appressed.

The distribution map for *Melaleuca stenostachya* in Brophy *et al.* (2013) shows two occurrences in southern New Guinea. It is not known if these records are specimen-based; certainly there are no New Guinea records on the *Australasian Virtual Herbarium*

(AVH 2019), nor are there any New Guinea specimens at BRI, or at CANB (B. Lepschi *pers. comm*. March 2019).

***Conservation status*: Least Concern** (IUCN 2012). *Melaleuca stenostachya* subsp. *amplior* is widespread and relatively common.

***Etymology*:** The epithet is from the Latin *amplior* meaning 'larger'. This is given in reference to the leaves that are usually both longer and broader than in *M. stenostachya* subsp. *stenostachya*.

Melaleuca nervosa (Lindl.) Cheel, *J. Proc. Roy. Soc. New South Wales* 78: 65 (1944); *Callistemon nervosum* Lindl., in Mitchell, *J. Exped. Trop. Australia* 235 (1848); *M. leucadendron* var. ? *parvifolia* Benth., *Fl. Austral.* 3: 143 (1867), *pro parte; M. leucadendra* var. *nervosa* (Lindl.) Domin, *Biblioth. Bot.* 89: 457 (1928). **Type:** Queensland. Balmy Creek, July 1846, *T. Mitchell 241* (holo: CGE, *n.v.*; iso: BRI (fragm.), MEL 602745, MEL 602746, NSW (fragm.)).

Melaleuca nervosa (Lindl.) Cheel subsp. **nervosa**, Craven in I. Southwell & R. Lowe (ed.) *Behind the names: the botany of tea tree, cajuput and niaouli. Tea tree: the genus Melaleuca*: 23 (1999).

M. nervosa f. *latifolia* Byrnes, *Austrobaileya* 2: 74 (1984). **Type:** Northern Territory. About SE of Brock's Creek, 6 July 1946, *S.T. Blake 16344* (holo: BRI).

Leaves 45–83 mm long, 7–44 mm wide, 1.7–6.3 times longer than wide, with a dense cover of crisped hairs, and sometimes scattered antrorse to patent straight silky hairs on young leaves, mature leaves persistently hairy or glabrescent.

***Additional selected specimens examined*: Papua New Guinea.** Tarara, Wassi Kussa River, Dec 1936, *Brass 8407* (BRI); Morehead – Arufi road, Morehead subdistrict, Nov 1972, *Henty & Foreman NGF49420* (BRI, CANB, L). **Western Australia.** 10 miles [16 km] along track from main road to Mt Elizabeth Station, Jul 1973, *Aplin 5647* (BRI, PERTH); 12 miles [19 km] NE of Kalumburu Mission, Sep 1954, *Lazarides & Speck 4895* (BRI, CANB). **Northern Territory.** 37 miles [60 km] S of Oenpelli, Jul 1972, *Adams 2792* (BRI, CANB, K); Darwin area, Jul 1973, *Dunlop 3180* (BRI, CANB, DNA, NSW); Maude Creek, Jul/Aug 1911, *Spencer s.n.* (BRI [AQ43237]); 21 km W of Nimbuwah Rock, Jun 1972, *Symon 7969* (AD, BRI, CANB, K); 15 miles [24 km] NNE of Maranboy, Sep 1961, *Speck 1626* (BRI, CANB); near Margaret River, Sep 1946, *Blake 17082* (BRI, PE). **Queensland.** Cook District: Lotus Bird Lodge, Violetvale Station, Jul 2000, *Wannan 1897* (BRI, CANB); Kings Plains Station, entrance road, Nov 2016, *McDonald KRM18881* (BRI, CANB). Burke District: 187 km NW of Burketown on Woologorang Station, May 2008, *Thompson MORN123 & Wilson* (BRI); Croydon, Jul 1954, *Blake 19564* (BRI); S of Croydon, on Mittagong Station, Jun 1999, *Fox IDF261* (BRI). North Kennedy District: *c.* 20 km W of Greenvale towards Lynd Junction, May 1992, *Doust 281 & Brown* (BRI, NSW). South Kennedy District: 21.6 km N of Mirtna Homestead, May 1991, *Neldner 3111 & Thompson* (BRI). Mitchell District: Prairie, May 1936, *Blake 11587* (BRI). Leichhardt District: 29.1 km S of Emerald, Aug 1961, *Coaldrake QB213* (BRI). Port Curtis District: Kassman Drive NNE of Rosedale, Jun 1995, *Bean 8700* (BRI). Wide Bay District: 10.6 km S of Bundaberg, May 1972, *Chopping M72-1* (BRI).

***Distribution and habitat*:** *Melaleuca nervosa* subsp. *nervosa* occurs in the northern Kimberley region of Western Australia, the 'Top End' of the Northern Territory, adjacent to the Gulf of Carpentaria, and the eastern half of Queensland, as far south as Bundaberg. It is also present in the Western Province of Papua New Guinea (**Map 3**). It is commonly an understorey tree in eucalypt or *Melaleuca* woodland in areas that are inundated seasonally. The soils are generally sandy. Near the coast, it may inhabit quite steep hills and ridges.

***Notes*:** *Melaleuca nervosa* subsp. *nervosa* intergrades with *M. nerovsa* subsp. *crosslandiana* in the Aramac – Muttaburra area, the Croydon area and perhaps elsewhere.

Melaleuca nervosa subsp. **crosslandiana** (W.Fitzg.) Barlow ex Craven, *Behind the names: the botany of tea tree, cajuput and niaouli. Tea tree: the genus Melaleuca*: 23 (1999); *M. crosslandiana* W.Fitzg., *The Western Mail (Perth)* 21 (1066): 10, 25 (1906); *M. leucadendra* f. *crosslandiana* (W.Fitzg.) Cheel in Ewart & Davies, *Fl. Northern Terr.* 298 (1917). **Type:** Western Australia. Base of Mt Harris, June 1905, *W. Fitzgerald 1116* (lecto: NSW, *fide* Blake 1968: 43; isolecto: BRI, NSW).

Leaves 45–85 mm long, 5.5–19 mm wide, 4.1–9.7 times longer than wide, with appressed straight silky hairs on young leaves, mature leaves generally glabrous.

***Additional selected specimens examined*: Western Australia.** 3 miles [5 km] E of Broome, Jul 1966, *Moore 80* (BRI); Beagle Bay Mission, Kimberleys, Sep 1959, *Lazarides 6560* (BRI, CANB); 5 miles [8 km] SE of Gordon Downs Station, Jul 1949, *Perry 2467* (BRI, CANB); Salt Creek, *c.* 14 km N of Sandfire Roadhouse, then 27 km due E of Great Northern Highway, Jun 1981, *Kenneally 7575* (BRI, PERTH); 6 miles [10 km] SE of Blina Station, Kimberleys, Apr 1960, *Lazarides 6511* (BRI, CANB); New Cockatoo sand site, CSIRO Kununurra, Jul 1978, *Andrew 46* (BRI, DNA). **Northern Territory.** 16 miles [26 km] N of Helen Springs Station, Aug 1948, *Perry 1900* (BRI, CANB); 8 miles [13 km] N of Renners Springs, Jul 1956, *Forde 244* (BRI); near Tennant Creek, Jun 1946, *Blake 15986* (BRI); 35 miles [56 km] SSE of Victoria River Downs, Jun 1949, *Perry 2145* (BRI, CANB); 88.4 miles [142.2 km] N of Top Springs Store, Oct 1957, *Chippendale 3877* (BRI, NT); Bunda Station, Jun 1994, *Egan 4149* (BRI, DNA, MEL); 21 miles [34 km] ENE of Tipperary Homestead, Jul 1961, *Lazarides 6692* (BRI, CANB). **Queensland.** Burke District: Hells Gate roadhouse, in camping ground, Jun 2006, *Thompson WES787 & Hogan* (BRI); 45 km W of Normanton on Armstrong Creek, May 1970, *Webb & Tracey 13518* (BRI); Just S of Vena Park on track to Iffley, Jul 1999, *Fox IDF528* (BRI); *c.* 5 km NE of Solway Downs Homestead, *c.* 90 km directly NW of Richmond, Nov 1999, *Johnson & Turpin s.n.* (BRI [AQ745942]); 17 km NW of Gunpowder on Bar Creek Station, May 2006, *Booth 4503 & Kelman* (BRI, NSW); Wattle Paddock, 'Middle Park', N of Richmond, Jun 1999, *Bean 14998* (BRI). Gregory North District: Wills River, N of Boulia, May 2006, *Johnson & Edginton s.n.* (BRI [AQ742392]); Mort River crossing, 5 km ENE of Digby Peaks, Sep 1977, *Purdie 1043* (BRI). Mitchell District: N of Muttaburra, Aug 1994, *Fensham 1816* (BRI); 38 miles [61 km] S of Corinda, Jun 1949, *Everist 3877* (BRI).

***Distribution and habitat*:** *Melaleuca nervosa* subsp. *crosslandiana* has a wide distribution from Broome, Western Australia to Aramac, Queensland. It extends north to Douglas, Northern Territory, and south almost to Boulia in Queensland (**Map 3**). It inhabits sandy flats or hillsides, or in the driest parts of its range, watercourses. The associated species are generally small eucalypts (*Eucalyptus* spp. or *Corymbia* spp.).

***Notes*:** Blake (1968) included *Melaleuca crosslandiana* W.Fitzg., described from the Kimberley region of Western Australia, as a synonym of *M. nervosa* (Lindl.) Cheel. Then, in a valuable paper on the indumentum patterns of the *M. leucadendra* group, Barlow & Forrester (1984) showed that *M. nervosa* was divisible into two geographical races based on the indumentum morphology of the leaves, and that the race from the more arid regions included the type of *M. crosslandiana*. Barlow proposed these races as subspecies (determinavit slips dated 1984). Craven (1999) subsequently made the necessary combination, but in his key he separated the two subspecies using leaf width, leaf shape and *persistence* of the leaf indumentum. None of these characters was suggested by previous workers as being significant, while the very useful and consistent indumentum morphology difference was ignored. Craven & Cowie (2013) again relegated *M. crosslandiana* to synonymy with *M. nervosa*, saying that there is "too great an overlap in morphological features to warrant the continued recognition of *M. crosslandiana* at any rank". They stated that both *M. crosslandiana* and *M. nervosa* "have lanuginulose hairs on the branchlets and leaves". This is incorrect. The crisped (or lanuginulose) hairs are lacking in *crosslandiana*. They also stated that "the only non-overlapping feature that serves to distinguish *M. crosslandiana* from *M. nervosa* apparently is the occurrence of appressed hairs on the branchlets and leaves in the former species, and even this is not constant with spreading-ascending hairs also occurring". This I also believe to be incorrect – it is *M. nervosa sens. str.* that can have spreading-ascending hairs, especially in specimens from the Top End of the Northern Territory, while *M. crosslandiana* has consistently appressed straight hairs. Hence the separation between *M. nervosa* subsp. *crosslandiana* (leaves with appressed straight silky hairs) and *M. nervosa* subsp. *nervosa* (leaves with strongly crisped hairs, with or without spreading straight hairs) is straight forward and consistent, except for some minor intergradation at the geographical junction. Subspecies rank for *crosslandiana* is here considered eminently suitable.

Acknowledgements

I thank Nicole Crosswell for the illustrations.

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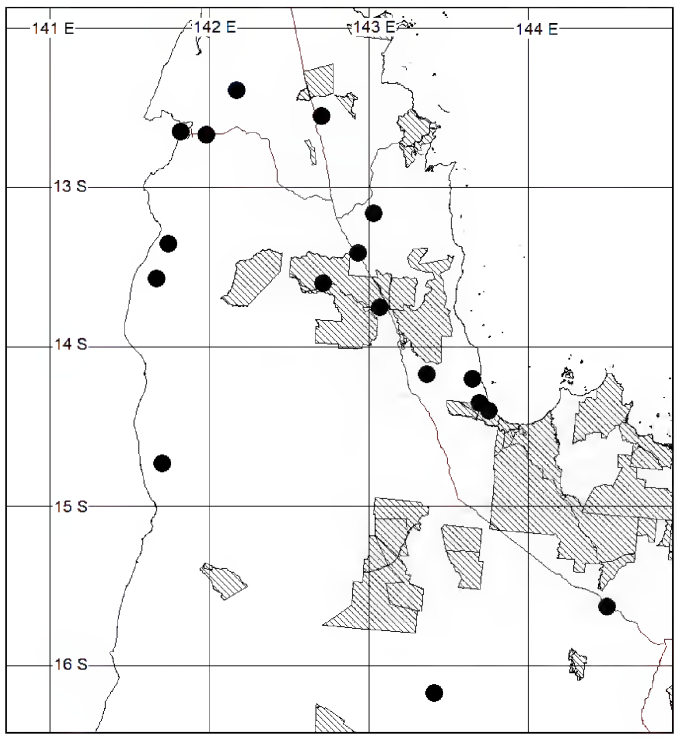
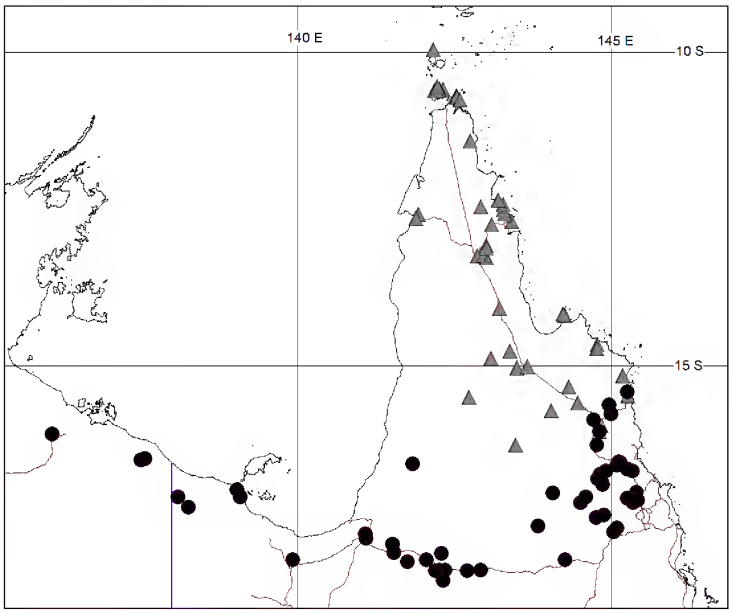
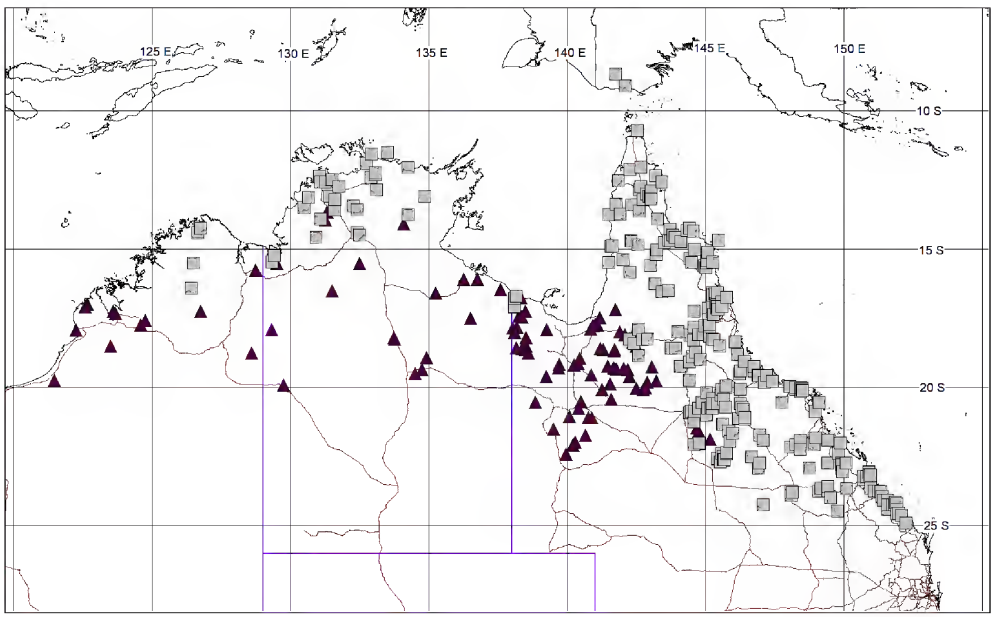


Map 1. Distribution of ***Melaleuca oblivia***.



Map 2. Distribution of ***Melaleuca stenostachya*** subsp. ***stenostachya*** ● and ***M. stenostachya*** subsp. ***amplior*** ▲.



Map 3. Distribution of ***Melaleuca nervosa*** subsp. ***nervosa*** ■ and ***M. nervosa*** subsp. ***crosslandiana*** ▲.

A taxonomic revision of *Olearia elliptica* DC. (Asteraceae: *Astereae*) with the description of two new species *O. fulgens* A.R.Bean and *O. praetermissa* (P.S.Green) A.R.Bean

A.R. Bean

Summary

Bean, A.R. (2020). A taxonomic revision of *Olearia elliptica* DC. (Asteraceae: *Astereae*) with the description of two new species *O. fulgens* A.R.Bean and *O. praetermissa* (P.S.Green) A.R.Bean. ***Austrobaileya* 10(4): 656–662**. The broadly circumscribed *Olearia elliptica* DC. is taxonomically revised and two new species *O. fulgens* A.R.Bean sp. nov., and *O. praetermissa* (P.S.Green) A.R.Bean comb. et stat. nov. are recognised. All three species are fully described with an identification key and a distribution map provided. A lectotype is chosen for *Olearia elliptica*.

Key Words: Asteraceae; *Olearia*; *Olearia elliptica*; *Olearia fulgens*; *Olearia praetermissa*; Australia flora; Queensland flora; New South Wales flora; new species; taxonomy; identification key

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Introduction

Olearia Moench is the largest genus of Asteraceae in Australia, with around 130 species (Lander 1992). Recent taxonomic and phylogenetic papers (Cross *et al.* 2002; Messina *et al.* 2013, 2014; Walsh 2014; Messina & Walsh 2019) have contributed to our knowledge of *Olearia*, but have also shown that further research is required to properly understand and elucidate the taxonomy and phylogeny of the genus.

Olearia elliptica DC. was originally described by Augustin de Candolle from a specimen collected by Allan Cunningham in the Illawarra region, south of Sydney. The current circumscription of *O. elliptica* (following the determinavit slips of N. Lander) is a broad one, encompassing all *Olearia* taxa from New South Wales (including Lord Howe Island) and Queensland with petiolate, alternate, viscid leaves.

It has long been recognised that two distinct forms of *O. elliptica* occur on the mainland (Stanley & Ross 1986; Harden *et al.* 2006; Leiper *et al.* 2017). In addition, an *Olearia* taxon from Lord Howe Island has been described as a subspecies of *O. elliptica*.

The two mainland forms can be separated readily in the herbarium merely by leaf size and shape, as well as glossiness and petiole length, but there are several other differences as outlined below. The two forms also occupy different habitats; one (*O. elliptica sens. str.*) grows in more easterly areas with higher rainfall; the second form grows in more westerly localities that receive lower rainfall. These two 'forms' are regarded as being specifically distinct, with the more westerly taxon here described as *O. fulgens* A.R.Bean sp. nov. The two species are allopatric except possibly in the Hunter Valley.

Olearia elliptica subsp. *praetermissa* P.S.Green, described from Lord Howe Island, differs from *O. elliptica sens. str.* in several morphological characters, and is here raised to species rank.

Materials and methods

This paper is based on a study of herbarium specimens held at BRI, CANB and MEL, and images of specimens at G, K and NSW, indicated as *i.d.v.* (*imago digitalis visa*). Specimens at NSW were not available for loan when this paper was prepared.

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Measurements were taken from dried material, except for individual florets, where they were taken from material preserved in spirit or reconstituted with boiling water. Dimensions are inclusive, *viz.* 1–1.7 indicates 1.0–1.7.

The distribution map was prepared using Diva 7.5.0 software. In the specimen citations, National Park is abbreviated as 'NP', and State Forest as 'SF'.

Taxonomy

Olearia elliptica DC., *Prodr. [A. P. de Candolle]* 5: 271 (1836); *Olearia elliptica* subsp. *elliptica*, P.S.Green, *Kew Bull.* 48: 311 (1993). **Type:** New South Wales. Illawarra, [October–November 1818], *A. Cunningham 27* (lecto: G 00494308 *i.d.v.* [designated here]; isolecto: K 000838958 *i.d.v.*).

Aster ellipticus DC., *Prodr. [A. P. de Candolle]* 5: 271 (1836), *nom. inval.*, *pro syn.*

Eurybia illita F.Muell., *Fragm.* 1: 16 (1858); *Aster illitus* (F.Muell.) F.Muell., *Fragm.* 5: 76 (1865). **Type:** Queensland. Moreton District: Mt Lindesay, *s.dat.*, *W. Hill s.n.* (syn: K 000838960 *i.d.v.*; syn: K 000838961 *i.d.v.*).

Olearia illita F.Muell., *Fragm.* 5: 76 (1865), *nom. inval.*, *pro syn.*

***Illustration*:** Leiper *et al.* (2017: 478).

Bushy shrub to 2 m high. Stems terete, but with several longitudinal ridges; glabrous, but with many viscid glands. Leaves alternate, petioles 10–17 mm long, not or obscurely decurrent; lamina elliptic to ovate, 65–113 × 19–37 mm (2.5–3.5 times longer than broad), markedly discolorous, viscid glands abundant on both surfaces, the exudate usually covering only part of the surface, giving a somewhat shiny, blotchy appearance; apex acute; margins entire or rarely toothed; venation faintly visible on upper surface, readily visible below, penninerved, with 5–7 pairs of lateral veins raised from the surface. Capitula terminal, in corymbose clusters of 10–30, pedunculate, radiate, 6–9 mm long, 7.5–9.5 mm diameter. Peduncles (2–)12–23 mm long, often with a few small bracts along their length. Involucral bracts 18–25, graduated in length, 3–4-seriate, outer surface with short hairs, viscid or not viscid; margins entire, scarious, apex obtuse; outer bracts ovate to elliptic, 1.4–3 × 0.7–0.9 mm, inner bracts rectangular to elliptic, 3.6–4.5 × 1–1.1 mm. Receptacle convex, 1.5–2.5 mm across, with short irregular projections between the floret scars. Ray florets 8–20, uniseriate, female, corolla tube 2.2–3.4 mm long, with sparse antrorse hairs; ligule 5–9 mm long, white to lilac, apex minutely 3-lobed; stylar arms lanceolate, 1.1–1.4 mm long. Disc florets 9–25, bisexual, yellow, corolla tube 3.2–4 mm long, with a few small antrorse eglandular hairs; corolla lobes 5, 1–1.5 mm long, acute, outer surface glabrous; anthers *c.* 1.5 mm long, not caudate. Achenes forming from both disc and ray florets, cylindrical, slightly dorsi-ventrally flattened, 2.6–3.2 mm long, with 4 or 5 prominent longitudinal ribs and sparse antrorse eglandular hairs throughout, carpopodium small, white, slightly oblique. Pappus comprising 20–30 white or straw-coloured barbellate bristles all equal in length, 4.5–4.9 mm long, barbellae < 0.05 mm long, and occasionally with 3–7 short bristles (0.3–0.4 mm long) in an outer whorl, thinner than the inner whorl. *Sticky daisy-bush.*

***Additional selected specimens examined*: Queensland.** Moreton District: Bithongabel Lookout, Lamington NP, Dec 1960, *Smith 11286* (BRI); Wagawn, Aug 1960, *Blake 21361A* (BRI); National Park, Macpherson Range, Jan 1919, *White s.n.* (BRI [AQ249690]); Springbrook, Dec 1969, *Smith s.n.* (BRI [AQ410828]); Mt Merino summit, Lamington NP, Jan 1995, *Forster PIF16070 & Leiper* (BRI, MEL); Mt Lindesay, Nov 1990, *Forster PIF7556* (BRI, MEL, PERTH); Best of All Lookout, Springbrook, Nov 1976, *McDonald 1701 & Batianoff* (BRI). **New South Wales.** Northern Tablelands: Double head, Carrai Plateau, Sep 1980, *s.coll.* (CANB 00502632); Point Lookout, New England NP, Nov 1997, *Donaldson 1811* (CANB); Apsley Falls, SE of Walcha, Dec 1970, *Telford 2726* (CANB). North Coast: Whian Whian, Oct 1964, *Jones 2893* (CANB); Whian Whian SF, Jul 1956, *Webb & Tracey 15* (BRI); Tyalgum Ridge, Macpherson Range, *c.* 25 km WNW of Murwillumbah, Dec 1977, *Haegi 1528* (BRI, NSW). Central Coast: Cessnock – Broke Road, W of Tyrrells Vineyard, Mar 2010, *Purdie 7651* (CANB, NSW); Budderoo NP, N of Minnamurra Falls, *c.* 2 km E of Knight's Hill, Oct 1993, *Gilmour 7506* (CANB, MEL); Yengo NP, access through 'Darrowby', *c.* 3.5 km W of Broke on the road to Milbrodale, Mar 1991, *Palmer 337* (CANB). Central Tablelands: Blue Mountains NP, Wentworth Falls, Princes Rock lookout, Oct 2011, *Schmidt-Lebuhn 1249*

(CANB); Fitzroy Falls, along walking track to fall from visitor centre, Oct 1996, *Errington 556* (NSW). South Coast: Jervis Bay, Aug 1968, *Groot Oblink s.n.* (CANB cbg15227.1).

***Distribution and habitat*:** *Olearia elliptica* occurs from the Lamington National Park, Queensland to Jervis Bay, New South Wales (**Map 1**). It grows in *Eucalyptus*-dominated open forest or rainforest edges where the annual rainfall exceeds 1000 mm. Altitude varies from near sea level at the southern end of its range to 1150 metres at the Queensland – New South Wales border.

***Phenology*:** The majority of flowering and fruiting specimens were collected from October–December. A few fertile specimens have been collected in August, and from January–April.

***Notes*:** A few specimens from the Hunter Valley of New South Wales are somewhat intermediate between *Olearia elliptica* and *O. fulgens*, and it is possible that some genetic interchange is occurring in that area.

Olearia fulgens A.R.Bean **sp. nov.** with affinity to *O. elliptica* but differing by the narrower, more glossy leaves, with the lateral veins not raised, the shorter achenes, the shorter corolla lobes on the disc florets, and the presence of tiny hairs on the corolla lobes of the disc florets. **Typus:** Queensland. Darling Downs District: State Forest 595, Talgai, Mount Gammie North, 9 January 1993, *D. Halford Q1630* (holo: BRI; iso: MEL, NSW).

***Illustration*:** Leiper *et al.* (2017: 186) [as *O. elliptica*].

Bushy shrub to 2.5 m high. Stems terete, but with several longitudinal ribs; glabrous, but with many viscid glands. Leaves alternate, petioles 5–10 mm long, not decurrent; lamina narrowly elliptic to lanceolate, 43–88 × 10–21 mm (3.6–5.5 times longer than broad), slightly to markedly discolorous, viscid glands abundant on both surfaces, the exudate often covering the entire surface, giving a shiny, varnished appearance, or covering only part of the surface, giving a blotchy appearance; apex acute to acuminate; margins entire; venation not visible on upper surface, but faintly visible below, penninerved, with 4–6 pairs of lateral veins not raised from the surface. Capitula terminal, in corymbose clusters of 7–25, pedunculate, radiate, 6–7.5 mm long, 7–9 mm diameter. Peduncles 5–14 mm long, often with a few small bracts along their length. Involucral bracts 18–25, graduated in length, 3–4-seriate, outer surface glabrous, often viscid; margins entire, scarious, apex obtuse to acute; outer bracts ovate to elliptic, 1.1–1.8 × 0.5–0.7 mm, inner bracts elliptic, 2.6–3.6 × 0.8–0.9 mm. Receptacle convex, 1.2–2 mm across, with short irregular projections between the floret scars. Ray florets 6–14, uniseriate, female, corolla tube 2.1–2.7 mm long, with sparse antrorse hairs; ligule 4.5–6 mm long, white, apex minutely 3-lobed; stylar arms filiform, 1.1–1.5 mm long. Disc florets 8–14, bisexual, yellow, corolla tube 3.8–4.3 mm long, with a few small antrorse eglandular hairs; corolla lobes 5, 0.7–1.1 mm long, acute, outer surface with a few small eglandular hairs; anthers *c.* 1.5 mm long, not caudate. Achenes forming from both disc and ray florets, cylindrical, slightly dorsi-ventrally flattened, 2.1–2.7 mm long, with 4 or 5 prominent longitudinal ribs and sparse antrorse eglandular hairs throughout, carpopodium small, white, slightly oblique. Pappus comprising a single whorl of 25–35 white or straw-coloured barbellate bristles all equal in length, 3.3–4.8 mm long, barbellae < 0.05 mm long. *Peach-leaved daisy-bush*. **Fig. 1**.

***Additional selected specimens examined*: Queensland.** Leichhardt District: Carnarvon NP, Buckland Tableland section, via Tanderra, SW of Springsure, Aug 2004, *Eddie Lot 6 & McDonald* (BRI). Burnett District: *c.* 4 km SSW of Elgin Vale, Jan 1991, *Pedley 5591* (BRI, K, MEL). Warrego District: Near Caldervale – Kyber Road, SE of Tambo, May 2010, *Bean 29830* (BRI). Maranoa District: 'Oakwells', W of Injune, Jan 2008, *Eddie BC027 & Cosh* (BRI); 'Andromeda', *c.* 25 km NNE of Mungallala, Mar 2015, *Mathieson MTM2001* (BRI); Mt Mobil section of Chesterton Range NP, Sep 1995, *Bean 8970 & Grimshaw* (BRI). Darling Downs District: *c.* 35 km E of Texas, Jan 1973, *Pedley 4062* (BRI); Gowrie, *s.dat.*, *Bailey s.n.* (BRI [AQ249686]); W of Kogan on Condamine Highway, Aug 1951, *Webb s.n.* (BRI [AQ249676]); Forest Lookout, Jack Creek, 17 miles [*c.* 28 km] WNW of Millmerran, Aug 1969, *Ward WW83* (BRI); 3 km W of Gladfield, Jun 1986, *Forster PIF2469 et al.* (BRI, NSW); Mt Bullaganang, Mar 1994, *Forster PIF15054* (BRI, MEL); Durakai SF, Dec 1999, *Thompson WAR16*

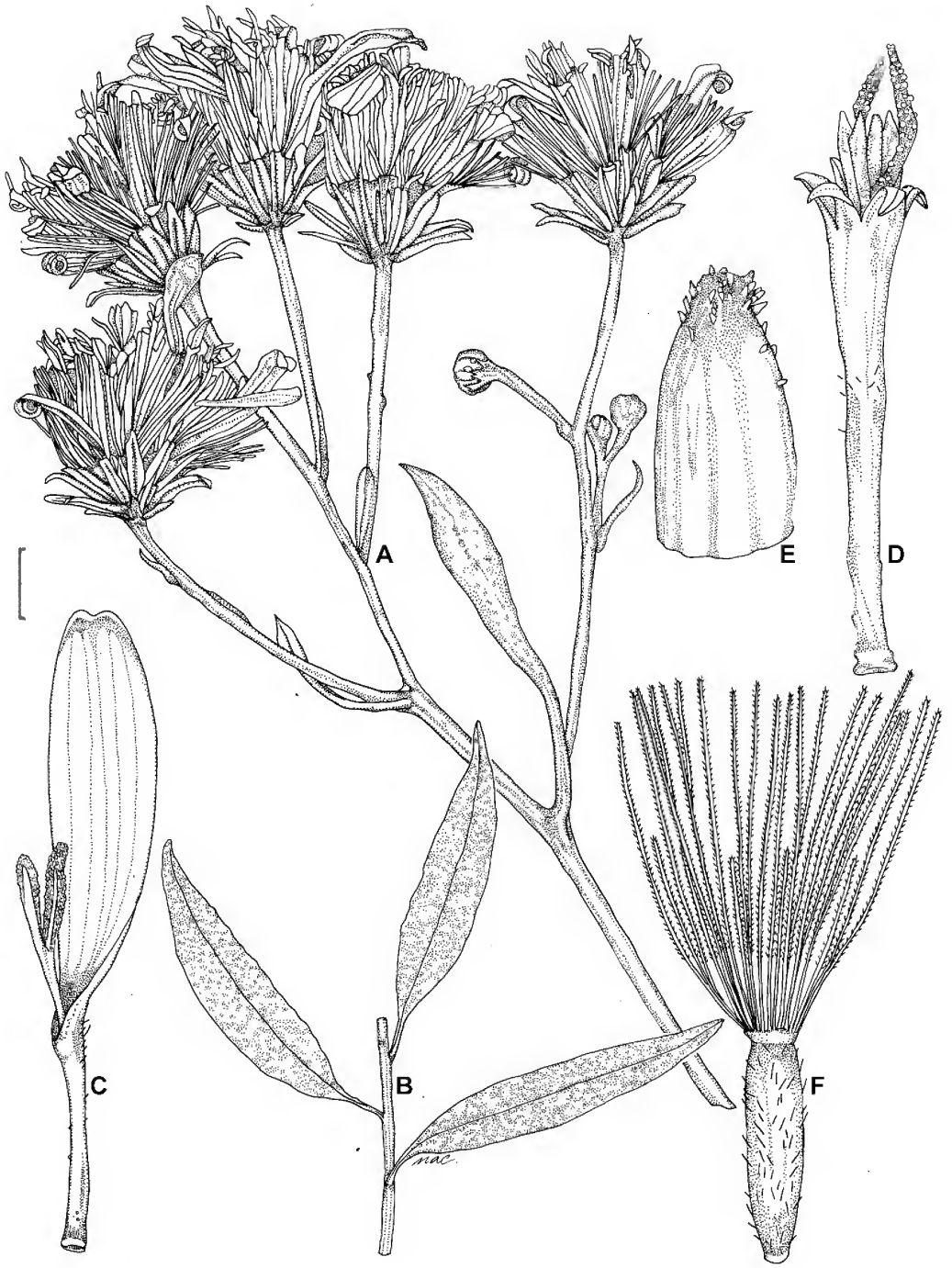

Fig. 1. ***Olearia fulgens***. A. flowering branchlet ×3. B. leaves ×1. C. ray floret ×10. D. disc floret ×15. E. apex of disc corolla before anthesis ×40. F. achene and pappus ×10. A,C,E from *Thompson WAR16 & Weatherhead* (BRI); B from *Ward WW83* (BRI); D from *Bean 11627* (BRI); F from *Eddie BC027 & Cosh* (BRI). Scale bar = 10 mm at ×1 magnification. Del. N. Crosswell.

& Weatherhead (BRI); *c.* 12 km S of Dunmore Forest Station, via Cecil Plains, Jan 1997, *Bean 11627* (BRI); Pincotts Road between Mt Colliery and Gambubal, Jan 2012, *Forster PIF38542 & Leiper* (BRI, NSW, US); between Karara and Cobba-da-mana, May 1936, *Everist & White 3* (BRI). Moreton District: Bidwillii Logging Area, SF 283, NNE of Blackbutt, Nov 2005, *Bean 24475* (BRI). **New South Wales.** North West Slopes: 'Cuff-n-Collar', 11 km WNW of Warialda, S of Mosquito Creek Road, Mar 2011, *Forster PIF37867 & Hodge* (BRI, NE); Munro SF, on Bingara – Copeton Dam Road, 35 km SE of Bingara, Jan 2005, *Orchard 7394* (BRI, CANB, MEL); Warrumbungle NP car park, Jun 1986, *Clarke s.n.* (BRI [AQ493639]). Northern Tablelands: Kildare Road, 0.1 km S of Bruxner Highway, NW of Tenterfield, Apr 2004, *Bean 21898* (BRI, MEL, NSW); 7.8 km SW of Tenterfield, Feb 2006, *Bean 24674* (BRI, NSW); *c.* 8 km along the road from Kingstown towards Uralla, Mar 1997, *Lyne 2160* (BRI, CANB, NSW, PERTH). Central West Slopes: 14 km S of Bundella – Bomera Road on Pandora's Pass Road, Liverpool Range, Feb 2004, *Orchard 7206* (CANB); Coorangooree Trig, 8 km from Stuart Town, Sep 1966, *Phillips 121* (CANB).

***Distribution and habitat*:** *Olearia fulgens* occurs from near Tambo and Springsure in Queensland, to Stuart Town and Capertee Valley in New South Wales (**Map 1**). It grows in *Eucalyptus – Callitris* woodland on hillsides and ridges with infertile soil, where the annual rainfall is 600–800 mm.

***Phenology*:** Most flowering and fruiting specimens were collected from December to April, while a few were collected in May and June.

***Affinities*:** *Olearia fulgens* differs from *O. elliptica* by its narrowly elliptic to lanceolate leaves, 3.6–5.5 times longer than broad (versus elliptic to ovate, 2.5–3.5 times longer than broad for *O. elliptica*); the lateral veins not raised (and obscure) on the lower leaf surface (versus lateral veins raised and prominent on lower leaf surface for *O. elliptica*); petioles 5–10 mm long (10–17 mm long for *O. elliptica*); the glabrous involucral bracts (versus involucral bracts sparsely hairy at distal end for *O. elliptica*); the presence of tiny hairs on the corolla lobes (outer surface) of the disc florets (versus glabrous lobes for *O. elliptica*); the corolla lobes of the disc florets 0.7–1.1 mm long (1–1.5 mm long for *O. elliptica*); and the achenes 2.1–2.7 mm long (2.6–3.2 mm long for *O. elliptica*).

***Etymology*:** From the Latin *fulgens*, meaning 'gleaming, shining'. This is in reference to the very shiny leaves possessed by this species.

***Notes*:** *Olearia fulgens* flowers mainly in the summer and autumn months, whereas *O. elliptica* is predominantly a spring-flowering species.

Olearia praetermissa (P.S.Green) A.R.Bean **comb. et stat. nov.**; *O. elliptica* subsp. *praetermissa* P.S.Green, *Kew Bull.* 48: 311 (1993). **Type:** New South Wales. Lord Howe Island, 25 March 1971, *A.N. Rodd 1771* (holo: K 000838957 *i.d.v.*; iso: NSW *n.v.*).

Bushy shrub 0.25–1 m high. Stems with several longitudinal ridges; glabrous, but with some viscid glands. Leaves alternate, petioles 4–13 mm long, not decurrent; lamina oblanceolate to obovate, 24–53 × 9.5–17 mm (2.3–3.9 times longer than broad), slightly discolorous, viscid glands present on both surfaces, the exudate usually covering only part of the surface, giving a somewhat shiny, blotchy appearance; apex obtuse or acute; margins entire; venation not visible on upper surface, and faintly visible below, penninerved, with 2–4 pairs of lateral veins not raised from the surface. Capitula terminal, in corymbose clusters of 4–15, pedunculate, radiate, 6–7 mm long, 7–9 mm diameter. Peduncles 5–12 mm long, with several small bracts along their length. Involucral bracts 20–30, graduated in length, 2 or 3-seriate, outer surface glabrous or with short hairs, viscid; margins entire, scarious, apex acute; outer bracts ovate to deltate, 1.2–2.2 × 0.6–0.8 mm, inner bracts rectangular to lanceolate, 3.2–3.6 × 0.7–1.1 mm. Receptacle flat to convex, 2–2.3 mm across, with short irregular projections between the floret scars. Ray florets 15–20, uniseriate, female, corolla tube 2.2–2.4 mm long, with sparse antrorse hairs; ligule 2.2–2.6 mm long, white, apex minutely 3-lobed; stylar arms lanceolate, 0.7–0.8 mm long. Disc florets 13–16, bisexual, yellow, corolla tube 2.5–3.3 mm long, with a few small antrorse eglandular hairs; corolla lobes 5, 0.7–0.9 mm

long, acute, outer surface glabrous; anthers *c.* 1.2 mm long, not caudate. Achenes forming from both disc and ray florets, cylindrical, slightly dorsi-ventrally flattened, 1.6–1.8 mm long, with 4 or 5 prominent longitudinal ribs and sparse antrorse eglandular hairs throughout, carpopodium small, white, slightly oblique. Pappus comprising an inner whorl of 15–20 pale brown or straw-coloured barbellate bristles all equal in length, 2.3–3 mm long, barbellae < 0.05 mm long, and an outer whorl of 7–15 white bristles 0.4–0.5 mm long, thicker than the inner whorl.

***Additional specimens examined*: New South Wales.** Near the Goathouse, NE slope of Mt Lidgbird, Lord Howe Island, Nov 1963, *Hoogland 8817* (CANB); S of Goat House cave, Lord Howe Island, Apr 1996, *Crawford 3819* (CANB); Goathouse, Mt Lidgbird, Lord Howe Island, Oct 1984, *Hutton 213* (CANB); cliff below Grey face, Mt Lidgbird, Lord Howe Island, Nov 1983, *Hutton 61* (CANB); below the Nobbin, Mt Lidgbird, Lord Howe Island, Jun 1991, *Hutton 656* (CANB); Goat House, N slope of Mt Lidgbird, Lord Howe Island, Oct 1978, *Crisp 4520 & Telford* (CANB).

***Distribution and habitat*:** *Olearia praetermissa* is endemic to Mt Lidgbird on Lord Howe Island (**Map 1**). It grows in basalt crevices on steep hillsides in open shrubland.

***Phenology*:** Flowering or fruiting specimens have been collected in the months of April, June, October and November.

***Affinities*:** *Olearia praetermissa* is similar to *O. elliptica*, but differs by the obovate to oblanceolate leaves (elliptic to ovate for *O. elliptica*); the consistent presence of two whorls of pappus bristles (usually one whorl only in *O. elliptica*); the ligules 2.2–2.6 mm long (5–9 mm long for *O. elliptica*); and the achenes 1.6–1.8 mm long (2.6–3.2 mm long for *O. elliptica*).

***Notes*:** In a molecular study, Cross *et al.* (2002) sampled both *Olearia elliptica s. str.* and *O. elliptica* subsp. *praetermissa*, and found little support for a sister relationship between these taxa, despite their similar morphology.

Key to the species allied to *Olearia elliptica*

1 Leaves obovate to oblanceolate; ray florets with ligules 2.2–2.6 mm long; achenes 1.6–1.8 mm long; pappus in two whorls . . . . . **O. praetermissa**
1. Leaves elliptical to ovate; ray florets with ligules 4.5–9 mm long; achenes 2.1–3.2 mm long; pappus usually in one whorl **2**

2 Leaves 3.6–5.5 times longer than wide; petioles 5–10 mm long; involucral bracts glabrous; corolla lobes of disc florets with tiny hairs . . . . **O. fulgens**
2. Leaves 2.5–3.5 times longer than wide; petioles 10–17 mm long; involucral bracts sparsely hairy at distal end; corolla lobes of disc florets glabrous . . . **O. elliptica**

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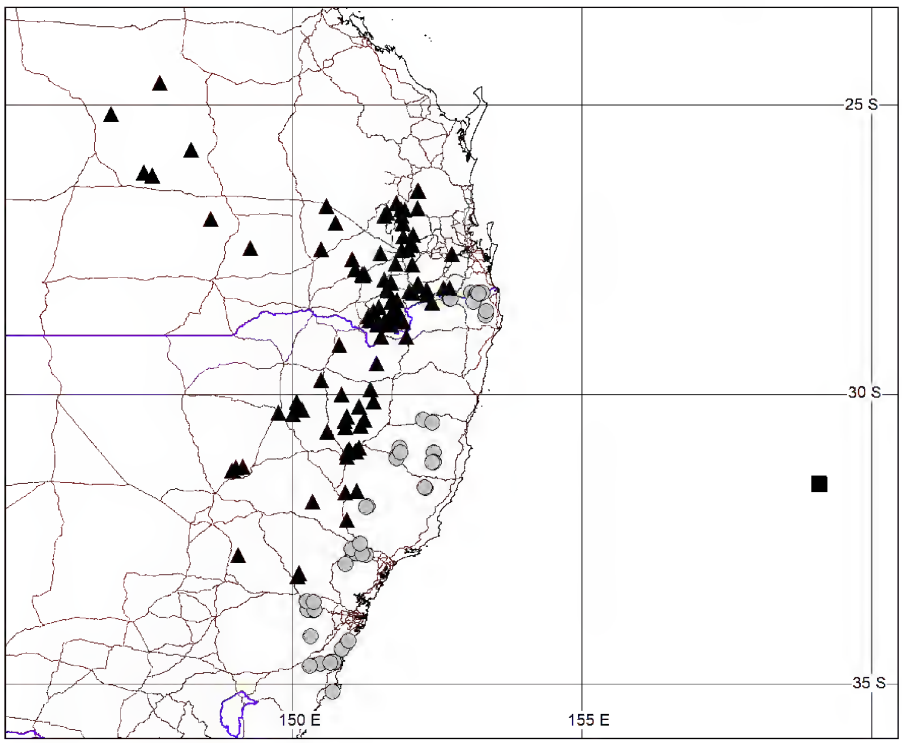

Map 1. Distribution of ***Olearia*** spp. ***O. elliptica*** ●; ***O. fulgens*** ▲, ***O. praetermissa*** ■.

SHORT COMMUNICATION

Lectotypification of three species names of Australian *Alpinia* Roxb. (Zingiberaceae)

A.R. Bean

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Rosemary M. Smith wrote a number of taxonomic and nomenclatural papers concerning Australian *Alpinia* Roxb. species late last century (Smith 1980, 1987, 1990), and lectotypified many of the taxon names. However, three Australian species names remain to be lectotypified. This is accomplished here.

This study is based on an examination of herbarium specimens at the Queensland Herbarium (BRI), as well as high quality images of specimens from BM, E, K and MEL and are indicated as *i.d.v.* (*imago digitalis visa*).

1. Alpinia arundelliana (F.M.Bailey) K.Schum. in Engler, H.G.A., *Pflanzenr. [Engler]* 20: 318 (1904); *Alpinia caerulea* var. *arundelliana* F.M.Bailey, *Proc. Roy. Soc. Queensland* 11: 18 (1895). **Type citation:** "recently spent ... a few days rambling through the rich semi-tropic vegetation of Eumundi". **Type:** Queensland. Moreton District: Eumundi, November 1894, *F.M. Bailey & J. Simmonds s.n.* (lecto: BRI [AQ0340707] [here designated]; isolecto: K 000928012, *i.d.v.*)

***Notes*:** Two specimens of *Alpinia arundelliana* collected before 1895 with the location 'Eumundi' have been found, one at BRI and the other at K. The BRI specimen is of somewhat better quality, and is chosen here as the lectotype.

The species epithet honours Edward Henry Arundell (1840–1910), a prominent early citizen of Eumundi, a town in south-eastern Queensland (Anon. 1911).

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2. Alpinia caerulea (R.Br.) Benth., *Fl. Austral.* 6: 265 (1873); *Hellenia caerulea* R.Br., *Prodr. Fl. Nov. Holland.* 308 (1810). **Type citation:** "(T. J !) v. v.". **Type:** Queensland. Port Curtis District: Port 2 Shoalwater Bay, Northumberland Islands in subumbrosis, 30 September 1802, *R. Brown s.n.* [*Bennett No. 5605*], (lecto: BM 000990752 [here designated], *i.d.v.*; isolecto: BM 000990751 [excl. piece from Hunter River] *i.d.v.*, E 00149518, E 00149519, E 00149520, E 00149521, E 00149522, E 00149523, all *i.d.v.*).

***Notes*:** In Brown's citation, "T" refers to tropical Australia, while "J" refers to the Port Jackson area of New South Wales (including the Hunter River). Most of Brown's material of this species is from the Northumberland Islands group off the east coast of Queensland, which contains the Percy Isles. A sheet at BM collected from the Northumberland Islands on 30 September 1802, and bearing both flowers and fruits, is here selected as the lectotype.

Brown's diary entry for 30 September records that he was ashore on Middle Percy Island. He stated that his party followed a gully with "water almost everywhere, in some places standing in holes, in others in small streamlets over the rocks" (Vallance *et al.* 2001). It is most likely here that the moisture-loving *Alpinia caerulea* was found and collected.

3. Alpinia modesta F.Muell. ex K.Schum. in H.G.A. Engler (ed.), *Pflanzenr. [Engler]* 20: 318 (1904). **Type citation:** "Nord-Australien: Rockingham-Bay (Dallachy, blühend am 15 Oktober 1867)." **Type:** Queensland. North Kennedy District: Mackay River, 15 October 1867, *J. Dallachy s.n.* (lecto: MEL

92943 [here designated], *i.d.v.*; isolecto: BRI [AQ0336128], K 000928013 *i.d.v.*, MEL 92942 *i.d.v.*).

***Notes*:** The protologue for *Alpinia modesta* specified a collection by John Dallachy made on 15 October 1867. A good quality specimen at MEL with these details is here selected as the lectotype; matching specimens at BRI, K, and MEL are considered to be isolectotypes.

The Mackay River in northern Queensland, which flows into Rockingham Bay and was visited by Dallachy, was renamed the Tully River in the 1870s (Collinson 1954).

Acknowledgements

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Acceptance of papers has depended on the outcome of review by referees. Those consulted for the current volume are listed below. Several were consulted on more than one occasion. Sincere thanks are extended to all these people whose expertise has helped to maintain journal standards.

R.L. Barrett
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